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A STUDY OF SOME PECULIAR CHANGES FOUND IN THE OXONS AND DENDRITES OF THE PURKINJE CELLS *

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INTRODUCTION

A peculiar balloon-like swelling of the dendrites of the ganglion cells was noted first by Schaffer¹ in amaurotic family idiocy. Later the same condition was observed in the apical dendrites of the Purkinje cells by Rogalski, Jansky, Schob, Bray, Sachs and Strauss,² Schaffer and others. This swelling of the dendrites was considered by these authors as one of the pathognomic findings of amaurotic family idiocy.

In 1906, Sträussler³ described the same kind of alteration among the dendrites of the Purkinje cells, together with similar swellings of the axis cylinders in a psychosis—in a woman 36 years of age—which manifested certain cerebellar symptoms associated with mental agitation and intellectual weakness. The cerebellum of this patient showed congenital malformation—defect of the granular layer. He attributed this peculiar change of the dendrites to their incomplete development and overwork.

In 1910, Sträussler, in a report on three cases of juvenile general paralysis, described a hypoplasia of the cerebellum and peculiar swellings of the dendrites and axis cylinders. He thought that these swellings were identical with those of amaurotic family idiocy and also with those shown in his previously described case. He believed, as a result of his studies, that there is an intimate relationship between juvenile general paralysis and hereditary family diseases, based on developmental defect of the central nervous system.

* From the Pathological Laboratory of Danvers State Hospital.

1. Schaffer: Zum normalen und pathologischen Fibrillenbau der Kleinhirnrinde, *Ztschr. f. d. ges. Neurol. u. Pathol.* **21**: 1, 1914.

2. Sachs and Strauss: The Cell Changes in Amaurotic Family Idiocy, *J. Exper. Med.* **12**: 685, 1910.

3. Sträussler: Ueber eigenartige Veränderungen der Ganglionzellen und ihrer Fortsätze im Centralnervensystem eines Falles von kongenitaler Kleinhirnatrophie, *Neurol. Centralbl.* **25**: 194, 1906.

So far as the writer has been able to determine from the literature these peculiar swellings of the dendrites have never been found in any other diseases than those mentioned above. As etiologic factors, most of the authors seem to favor congenital weakness, endogenous factors such as suggested by Sachs and Strauss in amaurotic family idiocy, and some external agent, such as overwork.

In the experimental study of Ramon y Cajal⁴ the injured dendrites of cerebral as well as cerebellar cells showed, as a rule, no regenerative reactions; but in one young animal experimented on, the dendrites of the Purkinje cells presented various nodular enlargements. Their reaction to the injury was also shown by a change in diameter, as well as in the form, length and structure of the secondary and tertiary branches.

Swellings of the axis cylinders have also been noted by various observers, and the explanations of the nature of these have been almost equally varied.

Cajal was the first to describe the swelling of the axons of the Purkinje cells resulting from experimental lesion. He called attention to certain terminal sacs (*les boutons terminaux*), some belonging to Purkinje cells, others to afferent fibers of the white substance. Most of these sacs were situated rather far from the lesion in apparently healthy tissue, while in the neighborhood of the lesion Purkinje cells were markedly degenerated, presenting a granular appearance, with no trace of intracellular neurofibrils. This led Cajal to believe that the sac formation is a reaction of the living protoplasm, and that it represents a regenerative process of the axons, whose continuity has been disturbed.

Rossi also observed the same interesting changes among axons of Purkinje cells in a case of cerebellar sclerosis. The axon was replaced by a round or oval mass, single, more rarely double, of homogeneous appearance, though sometimes showing within it a few fibers. This mass was generally encountered within the granular layer at a distance from the Purkinje cell, to which it was attached by a filament. He found also similar masses at the level of Purkinje cells where the latter seemed to be lacking. Most of the Purkinje cells exhibiting these changes were smaller and presented fewer dendritic arborizations. Some of these swellings were provided with processes which often threaded their way to the molecular layer in which they mingled with other nerve ramifications, thus rendering it impossible to determine the manner in which they terminated. Rossi interpreted the latter condition as a regenerative process of the preexisting normal collaterals.

4. Cajal: *Histologie du système nerveux de l'homme et des vertébrés*, traduite de l'Espagnol par le Dr. Azouley, 1909.

When the integrity of the Purkinje cells has been impaired by some cause or other, they no longer possess the ability to regenerate completely, and therefore they try to reproduce some other paths for their compensatory efforts. According to Rossi, this is the most important phenomenon from the point of view of the function of the organ.

Later Marinesco⁵ described structures identical with those described by Cajal and Rossi. He reported cerebellar symptoms had been shown clinically in one case, and at necropsy a large cystic cavity was found in the cerebellum. In another case a cerebral tumor, involving the left auditory nerve and severely compressing the cerebellum, was found at necropsy. One patient, a man aged 67, exhibited areas of softening in the cerebellar cortex, while the remaining patient had tubercle deep in the white substance of the cerebellum. Clinically, this last patient was a victim of Pott's disease. Marinesco summarizes his conclusions on the study of these cases as follows:

The fibers of the cerebellum, like those of the medulla, show a decided tendency to grow, if interrupted. We have seen them penetrate the interior of the softened region to great distances. Those which have not been able to penetrate have given forth new fibrillation at the limits of the healthy tissue. This zone can, then, from all points of view, be compared with the central end of a divided peripheral nerve.⁶ As to the other phenomenon which we have discussed as "*boule des axones de Purkinje*," the swelling of the fibers, the hypertrophy of the neurofibrillar plexus, whether dendritic or axonal, etc., these may be classed as phenomenon of nerve regeneration. Some authors class them among the regenerative phenomena, others regard them as of a degenerative nature. In our opinion they do not represent anything but a special reaction of the nerve cell and fibers, due to a disturbance of nutrition.

In 1914, Schaffer studied the normal and pathologic neurofibrillar structure in material from normal cerebella, amaurotic idiocy, tabes, taboparalysis and senile dementia. He described a peculiar swelling of the axons in the Purkinje cells in all pathologic groups; in amaurotic idiocy there was marked swelling of the dendrites. This differed from the earlier descriptions of amaurotic family idiocy by Sachs and Strauss. These observers did not note axonal changes in the Purkinje cells, though they did state that "the apical dendrite of pyramidal cells and axons were rarely affected," adding that they had "no theory as yet to account for this peculiar selective activity of the degenerative process." Schaffer observed two types of local swelling of the axons: One is stained pale, showing a loosened neurofibrillar structure; the other is dark and homogeneous, characterized by an argentophilic condition. In the cerebellum, therefore, the neuron is affected in all its constituents, that is, not only the cell body with dendritic arborization,

5. Marinesco: *Nouvelles contributions a l'étude de la régénérescence des fibres du system nerveux central*, J. f. Psychiat. u. Neurol. **17**: 131, 1913.

but the axon. In addition to focalized enlargements of axons, Schaffer described diffuse hypertrophies and atrophies of the axon of Purkinje cells. Schaffer interprets the focalized swelling of the axon as resulting from two causes: first, from hypertrophy of the axoplasm, and second, from the loosening of the neurofibrils following a solution of the interneurofibrillary substance (Axonkittsubstanz). This process is followed by a local deposition of the waste products of pathologic metabolism, which is suggested by the general argentophilic condition of these portions. These peculiar changes of the axon were associated with degeneration and diminution of the tangential and basket fibers in cases of tabes and taboparalysis.

In a case of congenital atrophy of the cerebellum, Sträussler described the swelling of the axons as well as of the dendrites. He attributed both of these conditions to the wasting of the cell and to certain congenital predisposition. Sträussler also observed the same peculiar swelling of the axon in juvenile general paralysis.

In 1918, Professor Kure, Dr. Hayashi of the Tokio Imperial University, and I, observed the same peculiar swelling of the axons in three cases of senile dementia, and reported them at a meeting of the Tokio Medical Association. At the time we suggested that they were probably common in the cerebella of senile dementia.

The swelling of the dendrites and axis cylinders have thus been reported by various observers under various pathologic conditions, and their opinions concerning the nature of these swellings vary. This study was made to endeavor to determine in what diseases these changes are likely to be found, and what significance they may have.

METHOD OF EXAMINATION

The material for this study was secured from brains of the Danvers State Hospital Laboratory series. These brains had been preserved in 14 per cent. formaldehyd solution. Particular care has been taken in the selection of suitable material, especially with respect to proper fixation and the time intervening between death and necropsy. Brains not hardened well and those that came to necropsy more than twenty-four hours after death have been excluded from this study. Small pieces have been taken from the upper and lower vermes, superior and inferior lobes of both hemispheres. Frozen sections have been made at 5 microns and stained by the Bielschowsky method. Ten slides have been studied from each block. Each preparation has been observed under low and high magnifications and the entire section studied. The sections contained, on the average, ten cerebellar foliae. Thus, 600 folia from each cerebellum have been carefully examined for the particular neurofibrillar changes.

In addition to Bielschowsky's method sudan III, thionin, Scharlach R., Weigert's glia staining, and other general staining methods have been employed.

HISTOLOGY OF THE CEREBELLUM

In the study of this problem consideration of the normal histology of the cerebellum cannot be omitted, more particularly the knowledge of the nerve fibers which are closely related to the Purkinje cells and their prolongation. I shall therefore first summarize the normal histology that has hitherto been described by various authors, particularly by Cajal; second, I shall give my own observations, which are more or less different from those already described.

It is convenient to describe the finer structure of the cerebellum under the following heads: the molecular layer, the intermediate or Purkinje cell layer, the granular layer, the white substance, and the basket and cushion fibers.

The molecular layer is occupied by small and large nerve cells. The large cells are found in the deeper part of this layer. The axis cylinders of these large cells have a certain relationship to the Purkinje cells. They run horizontally over the Purkinje cell layer, giving off collaterals at regular intervals. They finally approach one of the Purkinje cells, arborize around it, and form a kind of basket (Koelliker and Cajal). The collaterals also form baskets around the Purkinje cells. These cells of the molecular layer are called, accordingly, basket cells.

At the lower limits of the molecular layer, that is, in the intermediate layer, are found a large number of Purkinje cells, the largest in size of the elements of the cortex, and from a physiologic point of view considered as playing the most active part in the functions of the cerebellum.

The Purkinje cells possess dendrites that run through the whole thickness of the molecular layer. This cell is a voluminous spherical or ovoid body. It has a fibrillary structure. The fibers seem to wind around the nucleus, then turn away to course to the peripheral prolongations. It is worthy of note that the Purkinje cell contains, in comparison with other large cells of the brain, spinal cord, optic thalamus, etc., and very few pigment corpuscles. The rod shaped Nissl bodies are arranged in circular order around the nucleus, those in the base being larger than those in the apex. The apical dendrites also show rod shaped Nissl bodies. In silver preparations one can observe the collaterals of the axis cylinders which have a tendency to turn back toward the surface of the cerebellum, arborize around the neighboring Purkinje cells and continue further into the molecular layer. The axis cylinders go down into the white matter without diminution of caliber.

It is generally accepted that all the axis cylinders of the Purkinje cells pass through the cerebellar cortex to terminate in the cerebellar ganglions of the white substance. From the apex of the cell a short thick main stem of the dendrite is usually given off, which soon divides into two main stems that extend horizontally in opposite directions. From these two branches many other smaller branches are given off which extend toward the surface of the cortex, these in turn giving rise to many still finer branches which penetrate through the entire molecular layer. The atypical form of Purkinje cell, described by Cajal and others is triangular, conical or often star shaped, and is usually located in the molecular layer. Schaffer described this atypical form of the Purkinje cell in which he occasionally found two nuclei, one smaller than the other. The nucleus of this atypical form is, according to Schaffer, often of oval shape, while the nucleolus is always spherical.

Schaffer described more accurately the relation of the axis cylinders to the cell body. The axons, it is asserted, do not always spring from the base of the cell body, but sometimes originate in the lateral periphery. They arise from a conically shaped elevation of the protoplasm, immediately become very thin and stain faintly. A short distance from the cell the fiber suddenly becomes thicker and stains more darkly. This increased caliber of the fiber is probably due to the beginning of the myelin sheaths. Schaffer observed the collaterals of the axon mostly at a great distance from the Purkinje cell body, given off at acute angles and in directions contrary to the general course of the axon, noting also a bridge of some plasmic substance between the axonal stem and the collateral branch.

The granular layer is almost entirely composed of an agglomeration of small cellular elements of spheroidal shape. Each one possesses protoplasmic prolongations and an axis cylinder. The protoplasmic prolongations are three or four in number; they are short and thin, and, with few terminal branchings, they end in the granular layer. The axis cylinders of these cells ascend in the molecular layer and divide in a T-shaped manner, the branches extending horizontally and terminating freely among the end-arborizations of the dendrites of the Purkinje cells. In the granular layer, there are also several kinds of large nerve cells. Schaffer differentiates two kinds: one, a spindle form in the Purkinje cell layer, the other, a star shaped or multipolar cell, located in the deeper layer. The spindle shaped cells are of two types: one located in a horizontal position in the Purkinje cell layer with its long axis horizontal, and the other located in the upper part of the granular layer and disposed in either an oblique or in a perpendicular position. The dendrites of the first type share in the forma-

tion of the so-called cushion fibers. The prolongations from the lower pole of the second group arborize in the granular layer, while the prolongations from the upper pole mount into the molecular layer, mixing with the basket fibers of the Purkinje cells. The star shaped cells are rather large and possess a great number of prolongations which arborize freely in the immediate vicinity of their own cell bodies, thus forming a sort of network in the meshes of which a large number of granular cells may be enclosed. Some of these prolongations, however, mount upward to terminate in the molecular layer. Schaffer also described a peculiar basket formation around those nerve cells located near the Purkinje cells—a formation similar to that found around the Purkinje cells.

The white substance is formed by a mass of myelinated fibers which extend in opposite directions; one set of fibers is centrifugal, the other centripetal. The centripetal fibers are of two kinds: the mossy fibers of Cajal and the climbing fibers of Cajal and Koelliker. The mossy fibers arborize in the granular layer and enter into relation with granular cells. The climbing fibers ramify principally in the molecular layer and terminate at the dendrites of the Purkinje cells. The centrifugal fibers are entirely derived from Purkinje cells. Schaffer, Bielschowsky and Wolff observed, and described the climbing fibers. Schaffer, however, asserted that the ascending fibers did not always follow the course of the dendrites of Purkinje cells but sometimes left them to terminate in the gray substance of the molecular layer. After leaving the dendrites, they take either a horizontal course or an oblique or perpendicular course, attaching themselves transitorily to the dendrites and again losing themselves in the molecular layer.

Basket and Cushion Fibers.—The Purkinje cell layer is a place of rendezvous of fibers of different origin. These fibers arrange themselves chiefly in a vertical direction, that is, they extend from the base of the cell toward the main dendrite. Many fibers run partly in an horizontal, partly in an oblique, direction. These fibers thus form a kind of envelope around the Purkinje cell, as well as a cushion-like support. The enveloping fibers are called basket fibers and the fibers that extend horizontally are called cushion fibers. The basket fibers are derived, according to Cajal and Koelliker, from the basket cells of the molecular layer. Schaffer described these fibers accurately and illustrated them in his paper. The following are the important points of his description: Each collateral of the axis cylinders of the basket cells traverses the main dendrite and cell body and after sending a branch to the right and one to the left, sinks deep into the cushion fiber layer (*Polsterfaserschicht*) and becomes a part of the constituent elements of the cushion. It then runs either to a neighboring Purkinje

cell to take part in the formation of its basket, thus uniting two neighboring Purkinje cells, taking its course in the cushion fiber layer, passes on for a distance corresponding to two or three Purkinje cells, and there terminates around a Purkinje cell; meanwhile its caliber gradually diminishes. Schaffer also states that some of these collaterals, after they have shared in the formation of the basket, pass into the granular layer, the fiber accompanying an axon of the Purkinje cells, then take a sharp turn again finding their way to the fiber basket of the same Purkinje cell, while the others assume a curved course to join the fiber basket of remote Purkinje cells. Ascending fibers were also described by this observer: fibers from the granular layer to the elements of the basket, such as fibers from the spinocerebellar tract, dendrites of Cajal's star shaped ganglion cells of the granular layer and screwlike, winding, thick fibers, their origin unknown but probably derived from the white matter. Some observers have described direct communication between the fiber basket and the Purkinje cell body, but Schaffer contradicts these authors.

PERSONAL OBSERVATION ON NORMAL HISTOLOGY OF CEREBELLUM

Site of Purkinje Cells.—The Purkinje cells are usually found in the intermediate zone, that is, between the molecular and granular layers. A small percentage of these cells are found in the molecular layer, usually immediately above, and occasionally fairly far from, the normal location of the Purkinje cells (Fig. 1). Since this condition of dislocation of the Purkinje cells is commonly found in normal cerebella, it cannot be regarded as an heterotopia. If, however, Purkinje cells are found in the deeper parts of the granular layer or in the upper parts of the molecular layer, an interpretation of heterotopia is justifiable.

Atypical Form of Purkinje Cells.—Although the normal form of the Purkinje cells is spherical and somewhat depressed like a lens or the seed of a pumpkin, it presents several other forms. In the early part of the development, as shown in my study of several fetal brains, there is often a resemblance to a boat, the long axis being horizontal and situated partly in the molecular and partly in the granular layer. Some cells, however, are fairly far above the normal location in the molecular layer and wholly within this layer. The two extremities of the boat are dendritic prolongations which approach nearer and nearer in the course of development, finally meeting and forming the apical dendrite. There are, therefore, in the normal fully developed cerebellum, many transitory forms between the original and fully developed types. Some Purkinje cells have two main dendrites given off from the side of the cell body, while others present two main pro-

jections at the apex of the cell whose courses are in opposite directions, giving the cell the appearance of a uterus with tubes. Those cells which possess a single main stem also show a varied manner of branching, some dividing directly above the cell body, others at a distance from the apex, some having branches of equal thickness and others having branches of considerably different caliber. Purkinje cells found out of their normal position display more or less atypical forms in the general shape of the cell body, as well as in its mode of branching. A small number of cells, however, although normally located, present atypical forms even in normal cerebella. The small dendrite sometimes seen at the side of the cell body is regarded by some authors

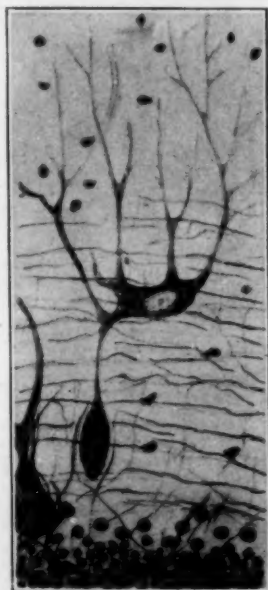


Fig. 1.—An abnormal location of the Purkinje cell whose axis cylinder is swollen.

as a pseudodendrite. The writer does not consider this a good term, since this is only a transitory stage in the formation of the apical dendrite and is purely a developmental characteristic. This, it seems to me, is important for the interpretation of the nature of the peculiar changes found in the cerebellar cortex.

The original embryonic shape of the Purkinje cells may assume in the course of development a variety of shapes—conical, stellar and bizarre forms. The radiating dendrites from the several parts of the cell body may at times be as many as four or five in number.

Dendrites of the Purkinje Cells.—The manner of arborization for the main stems has already been described. The Purkinje cells located in the sulci between the folia show generally an irregular arborization. Some Purkinje cells have dendrites that extend to great distances, while others possess short branches that terminate comparatively close to the cells. The dendrites given off from the sides of the cell body, which some authors regard as pseudodendrites, are sometimes very thin and have a few secondary branches which do not appear like ordinary branches of dendrites. The protoplasmic bridge between the two dividing branches, described by Schaffer, is frequently found, and should not be considered as pathologic. The spindle-like thickening of the main dendrites, which gives rise to a number of small arborizations, is also not a rare finding in the normal cerebellum. But when these swellings are found together with obvious pathologic changes of the bodies of the Purkinje cells or their dendrites, it is sometimes difficult to decide whether they are pathologic or normal.

The Axis Cylinders of the Purkinje Cells.—A knowledge of the normal anatomy of the axis cylinder is especially important for the study of our problem. The axis cylinders of the Purkinje cells are usually difficult to demonstrate, although in pathologic conditions they are likely to be increased in thickness, which makes their course and termination easier to follow. For this study of the normal structure, however, pathologic changes in axis cylinders or tissues from manifestly pathologic cerebella cannot be regarded as suitable. For the study of normal axis cylinders cerebella were used from three patients with manic depressive disease, from three with dementia praecox and from two subjects that were not insane, all in the third to fourth decades. While most of these cerebella were derived from subjects dying of psychoses, there were no gross pathologic changes in either cerebellum or cerebrum and no outstanding pathologic alterations in the cerebellum of any of the subjects.

The proximal portion of the axis cylinder is very delicate and consists of axoplasm and neurofibrils. After a short distance it increases in thickness, due to an addition of the so-called "Kittsubstanz," (gymnaxostroma and myeloaxostroma of Bielschowsky and Wolff). I have found that not all axons of the Purkinje cells enter the white matter. A certain number of axis cylinders, after extending a short distance into the granular layer, turn back toward the surface of the cerebellum in a bowl-like curve to arborize around its immediate neighbor or perhaps around more distant Purkinje cells. When the axis cylinder arborizes around neighboring Purkinje cells, it soon gives off a number of collaterals which seem to take part in the formation of the baskets. Some of these axis cylinders, even after reaching a fairly deep part

of the granular layer, turn back to terminate around the neighboring Purkinje cells. It may be questioned whether or not we are here dealing with collaterals of the axis cylinders instead of with the main stems. The caliber of the fibers, however, is always the same, and they show no abrupt turn in their course. Moreover, we do not normally see collaterals in the immediate neighborhood of the cell body. Certainly, those fibers that take a horizontal course from the sides of the Purkinje cells to the neighboring ones can only be explained, as axis cylinders. Another peculiarity of the axis cylinder is its round about course in the granular layer. Some of the axis cylinders which



Fig. 2.—Senile cerebellum showing degeneration of dendrites, tangential fibers, Purkinje cells and spheroidal cells of the granular layer. The vessels are relatively increased.

enter the white substance do not do so directly, but extend backward in a horizontal direction for a fairly long distance, finally curving in the opposite direction and entering the white matter.

The axis cylinders of the Purkinje cells usually extend from the base of the cell body; occasionally they extend from the side of the cell. In atypical Purkinje cells of the molecular layer axis cylinders frequently extend, not only from the abnormal part of the cell body, but also from the dendrites, and sometimes from dendrites far from the cell body (Fig. 2).

The collaterals of the axis cylinders are usually given off far from the cell body at an acute angle and directed toward the molecular layer. They divide, while in the granular layer, into several branches, which help in the formation of the cushion fibers and also share in the formation of the basket fibers. The collaterals seem to terminate in the molecular layer. Purkinje cells, therefore, seem to stand in an intimate relationship to each other, either by means of their axis cylinders or their collaterals.

Basket Fibers of the Purkinje Cells.—As for the basket formation around the Purkinje cells, we found about the same condition as described by Schaffer. In addition to this we observed axis cylinders and their collaterals taking part in the formation of the baskets. In a few instances I have also seen axis cylinders of the spindle formed cells included in the formation of the baskets.

Ascending Fibers of the Molecular Layer.—Not only so-called climbing fibers but all fibers ascending the molecular layer tend to lean against or pass over the dendrites of the Purkinje cells. This has been asserted also by Schaffer. I have clearly seen collaterals and axis cylinders from Purkinje cells and large cells of the granular layer as well as tangential fibers climb along the apical dendrites of Purkinje cells for a considerable distance. The fibers, therefore, climbing along the dendrites are not always the "climbing fibers" of Cajal and Koelliker.

STUDY OF PATHOLOGIC CASES

The swelling of axis cylinders and dendrites, in various pathologic conditions, has been noted in the foregoing. I have selected forty-one cases in which all the patients died of psychoses. These forty-one cases have been grouped under nine different categories to determine, if possible, the relationship of these peculiar changes to the following groups of diseases: (1) senile dementia, (2) arteriosclerotic brain disease, (3) general paralysis, (4) congenital brain diseases, (5) dementia praecox, (6) manic depressive insanity, (7) alcoholic and toxic psychoses, (8) brain tumors and (9) myxedematous psychosis.

GROUP I. SENILE DEMENTIA

CASE 1 (Case No. 20719, Aut. No. 2114).—Female; psychosis of four years' standing; died at the age of 78 from bronchopneumonia.

CASE 2 (Case No. 20150, Aut. No. 2116).—Female; died at advanced age of lobar pneumonia.

CASE 3 (Case No. 19760, Aut. No. 2008).—Male; psychosis of two years' standing; died at the age of 72 of arteriosclerosis.

CASE 4 (Case No. 19817, Aut. No. 2035).—Male; psychosis of ten years' standing; died at the age of 97 of bronchopneumonia.

CASE 5 (Case No. 19922, Aut. No. 2036).—Female; psychosis of several months' standing; died at the age of 71 of arteriosclerosis.

CASE 6 (Case No. 20887, Aut. No. 2086).—Female; psychosis of five years' standing; died at the age of 65 of cardiorenal disease with hypostatic pneumonia.

CASE 7 (Case No. 20507, Aut. No. 2082).—Female; psychosis of eight years' standing; died at the age of 73 of metastatic tumor of the mediastinum.

CASE 8 (Case No. 16964, Aut. No. 1990).—Male; psychosis of ten months' standing; died at the age of 76 of arteriosclerosis and hypostatic pneumonia.

CASE 9 (Case No. 19981, Aut. No. 2003).—Female; psychosis of one years' standing; died at the age of 87 of chronic nephritis and mitral regurgitation.

CASE 10 (Case No. 16657, Aut. No. 1924).—Female; psychosis of five years' standing; died at the age of 76 of arteriosclerosis.

CASE 11 (Case No. 19202, Aut. No. 1932).—Male; psychosis of two years' standing; died at the age of 80 of chronic nephritis and chronic valvular disease.

CASE 12 (Case No. 20064, Aut. No. 2026).—Male; psychosis of two years' standing; died at the age of 89 of interstitial myocarditis.

CASE 13 (Case No. 19458, Aut. No. 2027).—Female; psychosis of several months' standing; died at the age of 77 of arteriosclerosis and bronchopneumonia.

CASE 14 (Case No. 17444, Aut. No. 2030).—Male; psychosis of nine years' standing; died at the age of 74 of gangrene of the left lower extremity.

CASE 15 (Case No. 20558, Aut. No. 2050).—Male; died at advanced years of coronary sclerosis.

CASE 16 (Case No. 18638, Aut. No. 1877).—Female; died at the age of 87 of chronic nephritis.

Pathologic Observations on Group 1.—All patients in Group 1 presented fairly abundant senile plaques with or without Alzheimer degeneration of neurofibrils. Some patients presented softening and hemorrhagic areas due to cerebral arteriosclerosis, but these latter were included in this group because they exhibited senile plaques and diffuse fatty degeneration of ganglion cells.

In interpreting peculiar changes of dendrites and axis cylinders described in this paper one must not lose sight of the general associated pathologic changes shown in these cerebella and their possible causative or resultant relationship. Hence a description of both the general and special changes will be given.

The pia mater, in most cases, was thickened and showed a considerable amount of pigment substance. The walls of the pial vessels were thickened and revealed a more or less advanced degenerative fatty change. The molecular layer was diminished in width, particularly at the summit of the folia. The tangential fibers were reduced in number. The basket cells, which give origin to tangential fibers, showed marked changes of disintegration and many had disappeared. Together with the disappearance of the greater part of the dendrites, which will be

described later, the above mentioned condition gives the architecture of the molecular layer a very simple plan. Vessels that showed more or less sclerotic changes, however, appeared to be increased, owing largely, I think, to a diminution of intervacular nervous elements. It is to be regarded only as a relative increase of the vessels and unlike the proliferative processes of vessels which Alzheimer and others pointed out as occurring in general paralysis and some other chronic degenerative processes of the brain. In senile dementia, at least in our cases, the regenerative and proliferative processes of the vessels have not been observed.

Amyloid corpuscles were, in general, increased, particularly in the uppermost and deepest portions of the molecular layer, while in the middle portion of this layer they were rarely encountered. These corpuscles were readily stained by Bielschowsky's method, and took silver diffusely.

In striking contrast to the diminution or disappearance of other nerve elements, that is, tangential fibers, dendrites, Purkinje cells, etc., the number of basket and cushion fibers surrounding the Purkinje cells were not much impaired. These fibers, chiefly those in the intermediate or Purkinje cell layer, even seemed to be increased. Where atrophic Purkinje cells with a few stumps of dendritic arborization remained and even where Purkinje cells had disappeared, these fibers, more particularly cushion fibers, showed enormous masses of tangled fibers. This condition was most markedly observed in cases 4, 9 and 12, (Plate 1, Fig. 1), the patients being 97, 87 and 89 years of age, respectively. Most of the basket and cushion fibers were derived, as explained before, from the so-called basket cells, and it is difficult to explain why these fibers appeared to be increased while the cells from which they originated degenerated and decreased in number. Whether or not these seemingly increased fibers are to be interpreted as a compensatory proliferation of fibers from some other source of origin or merely as a relative increase due to emaciation and disappearance of the Purkinje cells, is difficult to determine. Schaffer, in his study of pathologic changes in neurofibrils of the cerebellum, observed the disappearance of basket and cushion fibers in cases of amaurotic family idiocy, taboparalysis and senile dementia. In our study of sixteen cases of senile dementia, the opposite condition obtained.

In the intermediate layer, there were more or less numerous fat corpuscle cells, more abundant than found in any other part of the cerebellum. The granular layer showed a diminution in small spheroidal cells, and the whole layer appeared to be lighter than normal. This condition made it rather easy to follow the course of the axons and afferent fibers of the white substance.



FIG. 1



FIG. 2

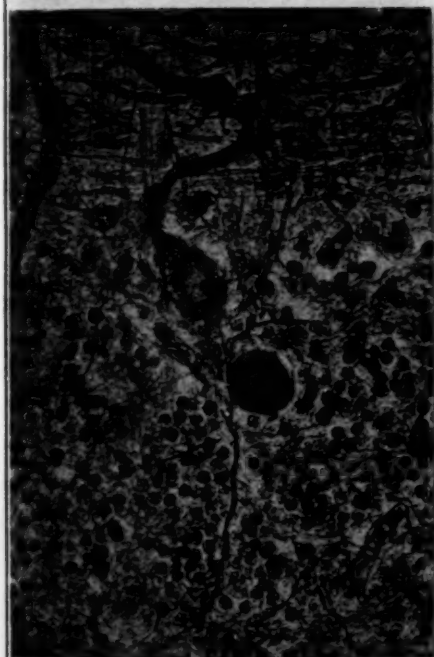


FIG. 3



FIG. 4

PLATE 1

- Fig. 1.—Senile cerebellum, showing enormously increased cushion fibers.
Fig. 2.—Spindle formed swelling of an axis cylinder.
Fig. 3.—Pedunculated form of the axonal swelling.
Fig. 4.—Spherical swelling of an axis cylinder.

In the white substance, fat corpuscle cells were less numerous than in the Purkinje cell layer. In some cases a degeneration of myelin sheaths was observed, always accompanied by arteriosclerotic changes in the cortex or white matter.

In the cerebrum all cases of this group exhibited fairly abundant senile plaques and most of them showed typical so-called Alzheimer degeneration of the neurofibrils. In the cerebellum senile plaques were found only in Case 1. The Alzheimer degeneration, while abundant in the cerebrum, was not encountered in the Purkinje cells.

The Purkinje cell changes were of various kinds and were not always the same for each case of the group. The cells were more or less reduced in number, especially at the summit of the folia. The summit of the folia seemed to be the most vulnerable part of the cortex of the cerebellum. Of sixteen cases, eleven (Cases 3, 4, 5, 9, 10, 11, 12, 13, 15 and 16) showed perceptible diminution of cells, marked and universal in Cases 4, 13 and 15.

Most of the Purkinje cells were somewhat swollen and the Nissl bodies had partly or entirely disappeared. Some cells, however, were sclerotic, protoplasmic substance and Nissl bodies being stained dark. The protoplasmic prolongations in both of these cells were stained well and could be traced to a considerable distance. Cases 8, 12 and 16 showed extremely advanced fatty degeneration, while Cases 1, 2, 3, 4, 5, 9, 10, 11, 14 and 15 presented fairly marked fatty degeneration. This condition of fatty degeneration did not show any parallelism with the age of the patient or the stage of arteriosclerosis of the cortex. It is well to note that the fatty degeneration in the Purkinje cells in Case 1, which presented typical senile plaques in the cerebellum, was less marked than in the other cases which did not show senile plaques.

The most interesting findings in our study of the cerebellum were certain peculiar changes in axis cylinders and dendrites, which form the basis of this paper. I shall first describe the manifold changes of the axis cylinders and then those of the dendrites. There are roughly distinguishable two kinds of changes in the axis cylinders; a diffuse hypertrophy and localized swellings. A combination of these two may be encountered.

In the majority of cases of Group 1 the axis cylinders of the Purkinje cells were increased in thickness, not only the axonal stems but also the collateral branches. These hypertrophic axons were stained homogeneously dark; their neurofibrils were not visible. Associated with this was a diffuse disappearance of spheroidal cells of the granular layer which made it easy to determine the course of the axis cylinders. In this group were observed many instances of axis cylinders of Purkinje cells which did not enter the white substance of the

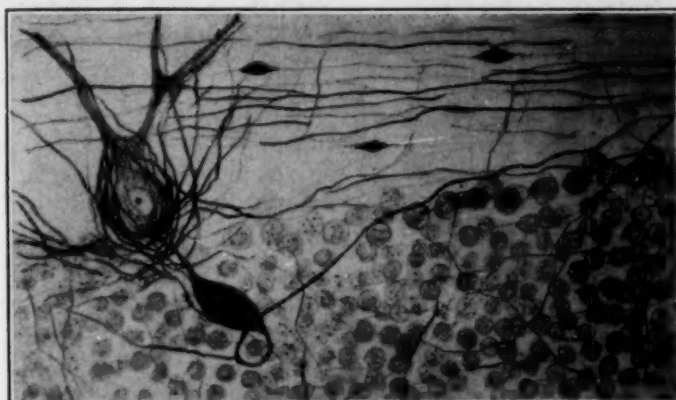


FIG. 1

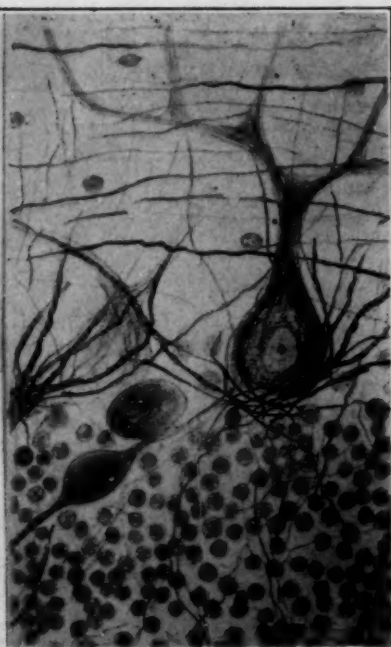


FIG. 2

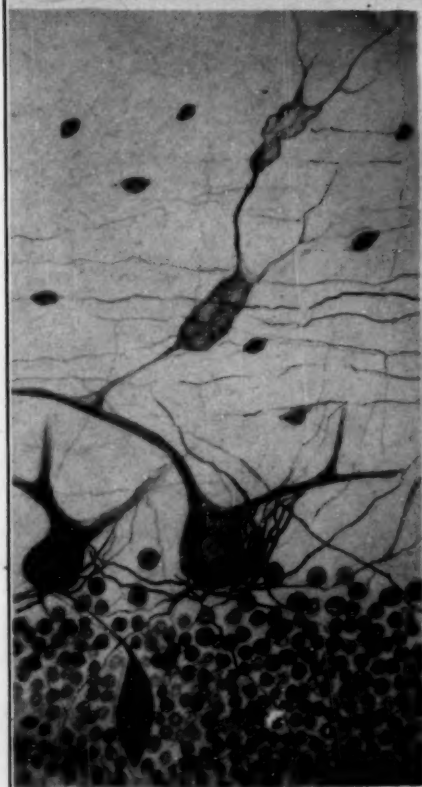


FIG. 4

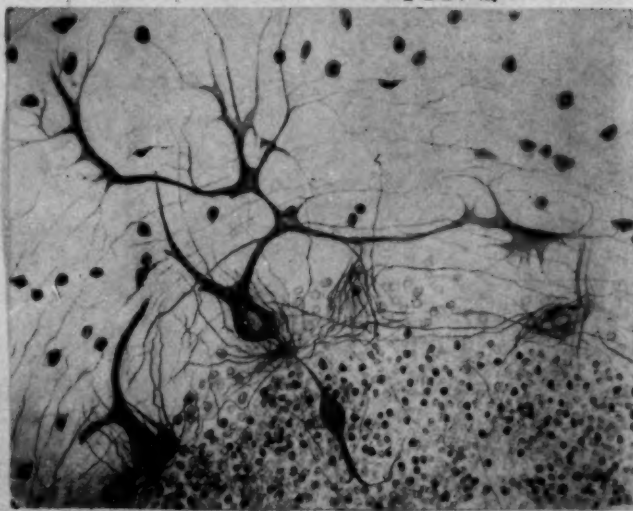


FIG. 3

PLATE 2

Fig. 1.—The axis cylinder presents a spindle formed swelling from which the axonal stem extends backward into the molecular layer.

Fig. 2.—A combination of pedunculated and spindle formed swellings of the axis cylinder.

Fig. 3.—Axonal and dendritic swellings of one and the same Purkinje cell.

Fig. 4.—Axonal and dendritic swellings.

cerebellum but which took their course to neighboring Purkinje cells, around which they arborized. This condition is normal, as mentioned in the consideration of the normal histology of the cerebellum, but in these cases it was decidedly noticeable because of the destruction of other nervous elements resulting in a simpler fiber pattern.

The localized swellings of axis cylinders which were identical with those described by Cajal, Rossi, Marinesco, Sträussler and Schaffer, were found in all the cases of senile dementia. They were most numerous in Cases 5, 6 and 11, numbering more than 50 in a small section (about 10 folia). The other cases, with the exception of Case 13,

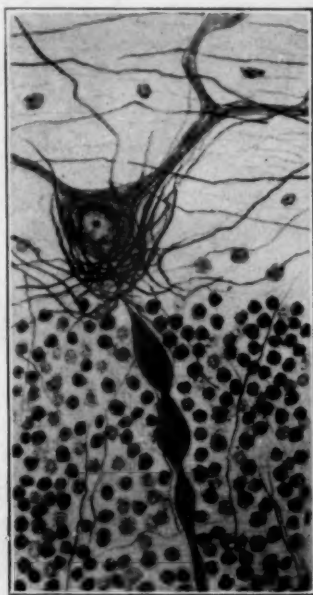


Fig. 3.—Beaded form of the axonal swelling.

exhibited from 5 to 20 swellings in a section of about the same size. In Case 13 only from 1 to 3 swellings were observed. Case 13 showed the most advanced cortical devastation, extreme fatty degeneration, marked disappearance of the Purkinje cells, considerable increase of amyloid corpuscles, etc. The histology of Case 5, which showed the most numerous examples of swellings, in contrast to Case 13, was comparatively normal, although individual Purkinje cells were more or less atrophic.

As a rule, Purkinje cells showing swellings of their axis cylinders are more or less atrophic, but not extremely degenerated. This perhaps explains why there were few axonal swellings in Case 13, in spite of the most marked degeneration of the cerebellar cortex, while in Case 5,

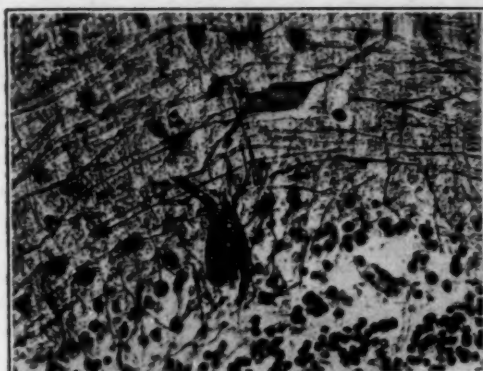


FIG. 1

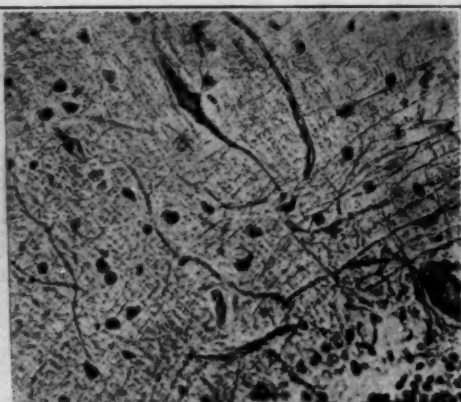


FIG. 2

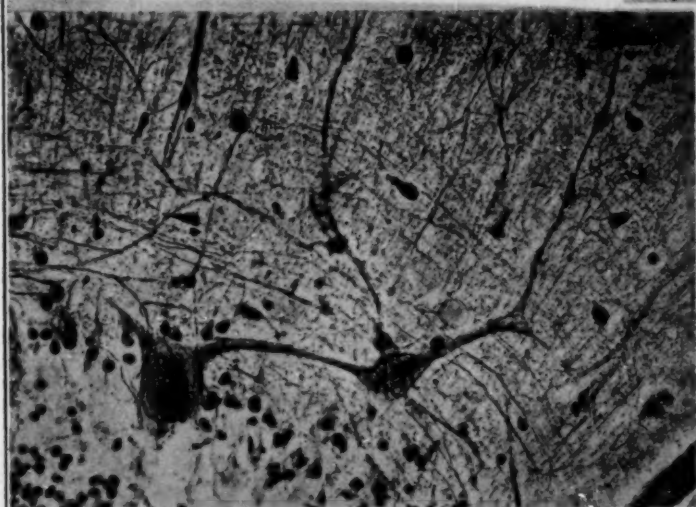


FIG. 3

PLATE 3

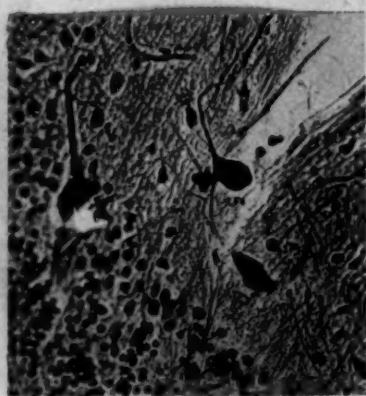


FIG. 4

- Fig. 1.—Spindle formed dendritic swelling.
 Fig. 2.—Localized hypertrophy of a dendritic prolongation.
 Fig. 3.—Dendritic swelling of Type 4.
 Fig. 4.—Pedunculated form of a dendritic swelling of an atypical Purkinje cell; P, Purkinje cell body; S, swelling; D, dendrite.

which presented most abundant swellings, the Purkinje cells were only slightly degenerated.

Axonal swellings were usually located not far from the cell body, some in the immediate neighborhood of the latter, others a little farther away, in the granular layer, but always in the upper half of the granular layer. In Case 6 the writer observed a swelling of an axon coursing from a Purkinje cell horizontally to a neighboring Purkinje cell. When atypical Purkinje cells which are located in the molecular layer display swelling of their axons, swelling is likely to be found in the molecular layer. In no cases studied was swelling observed in the deeper part of the granular layer or in the white substance of the cerebellum.

The swelling is of various shapes: (1) the spindle form, the most commonly observed in all of the cases (Fig. 1, Plate 1, Fig. 2) (2) the

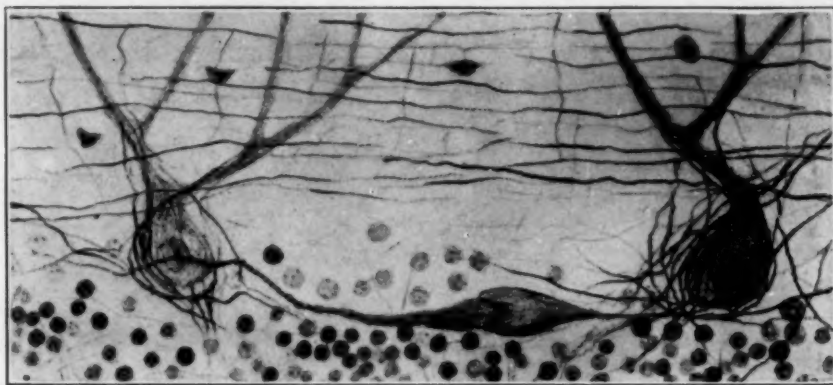


Fig. 4.—A peculiar type of axonal swelling resembling leaves of the cactus. Note also the transverse course of the axon.

conical form, less common, the apex of the cone turning either upward or downward (Fig. 2); (3) the spherical form, more rarely encountered (Plate 1, Fig. 4); (4) the beaded form, still more rarely observed, characterized by two or more spindle forms arranged like a string of beads (Fig. 2); (5) the pedunculated form, the rarest, characterized by hernia-like protrusion at the side of axonal stems (Plate 1, Fig. 3; Plate 2, Fig. 2; Plate 3, Fig. 4), and (6) the cactus like form, encountered in Case 6 (Fig. 4) in which an axis cylinder was swollen and from the swollen body another swelling issued, giving a resemblance to the leaves of the cactus.

Structure of the Swelling: The internal structure of the swollen body is not always the same. The great majority of the swollen bodies appear homogeneous, without any visible neurofibrillar structure. These homogeneous types are of two varieties, one staining pale, the other

dark (strongly argentophilic). A smaller number of the swelling bodies display definite intra-axonal neurofibrils; these, however, are pushed apart by some interneurofibrillar substance giving a loosely

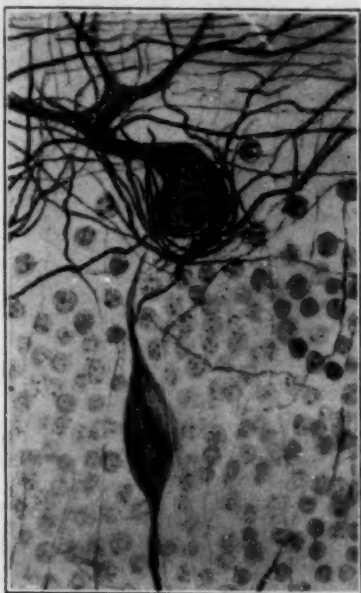


Fig. 5.—Alzheimer degeneration in the swelling of an axis cylinder.

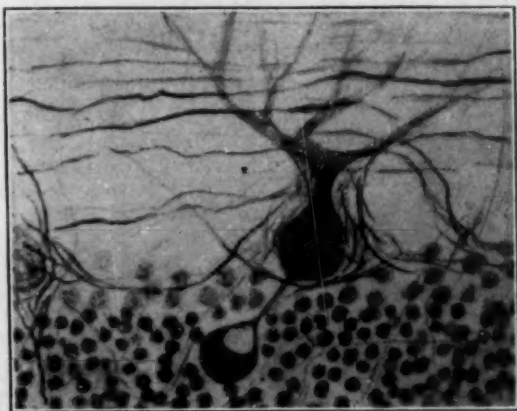


Fig. 6.—Vacuole formation in the swelling of an axis cylinder.

arranged appearance, the general direction of their course being unaltered. In a few cases I observed in one half of the swollen bodies a definite neurofibrillar structure and in the other half a more or less homogeneous argentophilic substance. I found in only two instances

thickening of neurofibrils and peculiar whirl-like structures suggesting Alzheimer degeneration of neurofibrils (Fig. 5). In the Purkinje cells, as mentioned before, no Alzheimer degeneration was found even after laborious search. This peculiar type of alteration found in two instances may possibly be of the same nature as Alzheimer degeneration. Other swollen bodies showed a coarse net formation, the interreticular substance being faintly stained. Still others displayed a dust-like substance in the swollen body, suggesting fragmentation of the intra-axonal neurofibrils. Vacuoles in the swelling of the axis cylinders, as shown in the illustrations of Marinesco's study, were not of

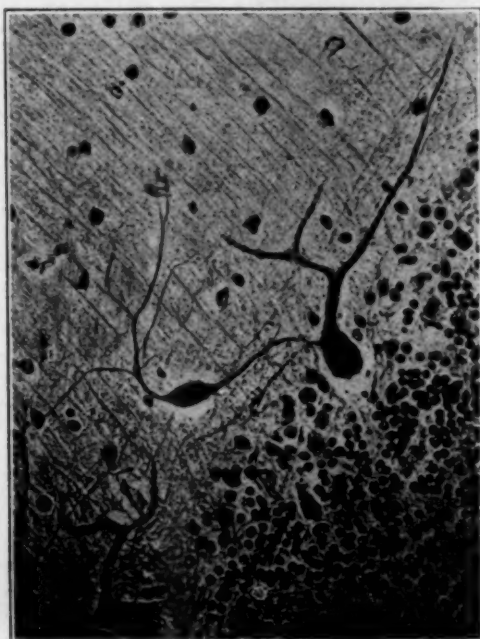


Fig. 7.—Spindle form swelling of a dendrite.

rare occurrence. Vacuoles were found mostly at the poles, rarely in the midportion of the swollen body (Fig. 6).

I tried to identify the substances in the peculiar swelling of axis cylinders by means of various methods of staining. In a small percentage lipoid substance, stained by sudan III and by the Marchi method, was demonstrated. The greater percentage of the swellings, however, showed no fatty content. A homogeneous substance with a glassy appearance was stained by the silver, in much the same manner as amyloid corpuscles, and some of these were markedly argentophilic. The exact nature of the substance is difficult to determine. Yet, the strong argentophilic character, the formation of vacuoles and

the deposition of fatty substance in some of them leads one to conclude that the processes are in part degenerative and in part regenerative, but that the latter are abortive.

Changes in the dendritic arborizations were not always alike for all the cases of this group. In Cases 1, 2, 6 and 8 the dendritic arborizations were well preserved, while in Cases 3, 7, 11 and 12 there was a partial disappearance of dendrites. Cases 4, 5, 9, 10, 13, 14,

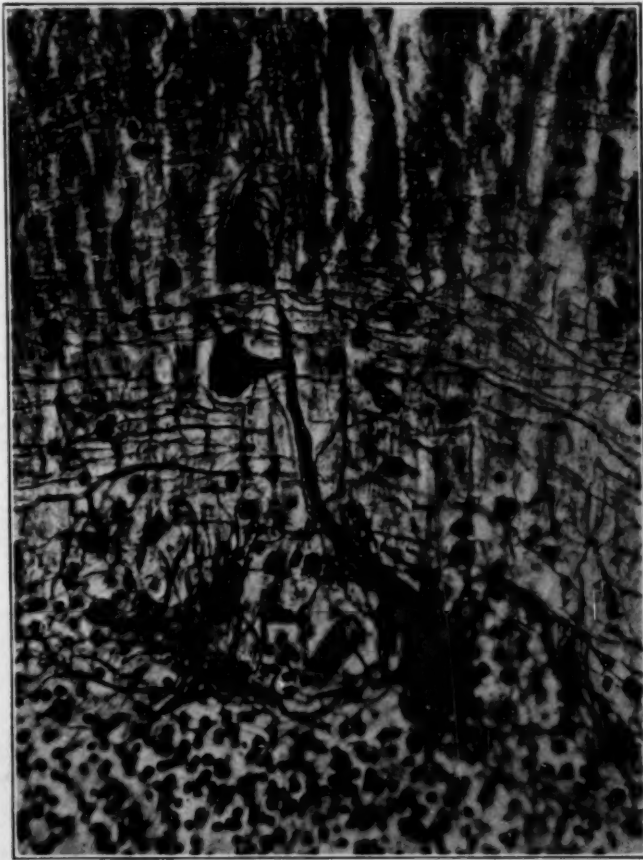


Fig. 8.—Pedunculated form of the dendritic swelling.

15 and 16 presented a well marked degeneration and an extreme scarcity of dendritic prolongations (Fig. 2). In these cases, Purkinje cells possessed only stumps of primary and secondary branches; other finer branches had all disappeared.

The peculiar swelling of dendrites, which I believe that I am the first to describe in senile dementia, were found in nearly all cases of this group, namely: 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15 and 16,

fourteen out of sixteen cases studied, or 87.5 per cent. These peculiar dendritic changes were not found in equal intensity in all of the cases. Cases 4 and 9, especially, showed only a few. Where the process was slight the changes were more likely to be found in sections from the worm, probably because this portion of the cerebellum is the most vulnerable. Cases 2 and 12, which gave negative results for these changes, might have shown the same peculiarities if sections from more parts had been studied.

The types of dendritic swellings found were: 1. Spindle Form: (Plate 3, Fig. 1). These swellings were usually located distant from the cell body and were similar in appearance and structure to those found in axis cylinders of the Purkinje cells. This form might also be found in the main stems of the apical prolongation or in the secondary and tertiary branches but they were most frequently found in the dendrites given off from the side of the cell body (Fig. 7). Marinresco, in his paper on cerebellar regeneration, illustrated a similar condition, which he described as a pseudodendrite. I could arrive at no satisfactory explanation as to why those dendrites given off from the side of the cell body were more frequently affected than the normal dendrites given off from the apex of the cell.

2. Pedunculated Form: This type varied in size and was usually found on the stem of the primary, secondary or tertiary branches. In Case 3, as illustrated in Figure 8, the main stem showed two peculiar sac-like swellings from which fibers were given off to terminate freely in the molecular layer. These fibers might possibly have been dendritic arborizations, but unlike them they took a more or less serpentine course.

3. Bulb-Like Form: This type was always found at the end of a fiber where it has much the appearance of an electric light bulb (Fig. 9).

4. The next type of swelling was more or less spindle shaped and was always found at the points of branching into finer dendrites (Plate 3, Fig. 3).

5. This type displayed enormously thickened dendritic stumps from which radiated a great number of fibers, which formed a more or less tangled mass (Figs. 10 and 13).

6. This type consisted of a diffuse thickening of primary and secondary branches (Plate 3, Fig. 2).

The contents of the swollen parts were as varied as the contents in the swellings of the axis cylinders. The spindle formed swellings usually contained a markedly argentophilic homogeneous substance and resembled similar swellings in the axis cylinders. Pedunculated swellings were either homogeneous glassy matter which in staining quality

is very much like amyloid. This homogeneous glassy matter was probably a semifluid metabolic substance, but this could not be determined. The diffusely hypertrophic dendrites usually had a neurofibril content. Some, however, stained homogeneously. Other swellings contained vacuoles, as in the case of axis cylinders. A certain number of these swellings presented fatty changes, which were readily stained by sudan III, Scharlach R. and the Marchi method, but in most instances I



Fig. 9.—Bulblike form of the dendritic swelling.

was unable to demonstrate any fatty substances. The strong argen-tophilic character, the homogeneous glassy appearance, the vacuole formation, etc., point, as in the case of axis cylinders, to their degenerative character. The cases presenting these peculiar swellings showed, in most instances, well marked dendritic disintegration, and their degenerative character.

But is this process only degenerative in character? I observed in many instances numerous small branches extending from the swollen body which were fusiform, sac form or irregular swellings of the den-

dritic stumps (Fig. 10). This and the diffuse hypertrophy of the dendrites would indicate the regenerative nature of the process, according to my interpretation. This will be discussed later.

GROUP II. ARTERIOSCLEROTIC BRAIN DISEASES

CASE 17 (Case No. 21348, Aut. No. 2118).—Male; psychosis of one months' standing; died at the age of 77 of arteriosclerosis and bronchopneumonia.

CASE 18 (Case No. 17300, Aut. No. 2115).—Female; psychosis of twelve years' standing; died at the age of 70 of arteriosclerosis.

CASE 19 (Case No. 21459, Aut. No. 2128).—Male; psychosis of four years' standing; died at the age of 92 of arteriosclerosis.

CASE 20 (Case No. 21142, Aut. No. 2103).—Female; psychosis of eight years' standing; died at the age of 48 of chronic vegetative endocarditis.

CASE 21 (Case No. 17376, Aut. No. 1915).—Female; psychosis of five years' standing; died at the age of 79 of profound cerebral hemorrhage.

Pathologic Observations on Group 2.—In the cerebrum, all cases showed areas of softening and hemorrhagic lesions. Cases 17 and 18 presented small hemorrhages in the white substance of the cerebellum, as well as in the pons. Case 21 exhibited a severe new intraventricular hemorrhage, which caused the death of the patient. The larger arteries of the cerebrum, as well as those of the cerebellum, were markedly sclerotic. This condition, however, was most profound in Case 21. Case 20, previously reported by the writer as an atypical form of arteriosclerotic brain devastation, presented a peculiar gross appearance quite like the moth-eaten condition (*etat vermoulu*) of Pierre Marie. Histopathologically the latter revealed "spongy degeneration of the cortex," in addition to hemorrhagic areas and softenings. In none of these cases were senile plaques or Alzheimer degeneration demonstrated.

The general histopathologic findings of the cerebellum varied in each case, as the group is vascular in origin and the changes depend on the grade of vessel alteration and location of diseased arteries, in this particular respect differing from the cases of the senile dementia described in the preceding group.

The cerebellar pia of these cases was irregularly thickened and adherent to the cortex by brushlike glia fibers (Fig. 11). The glia fibers of the border were here and there enormously thickened, often times dipping down into the molecular layer in areas which were wedge-shaped, the base of the wedge directed to the periphery. In the areas of arteriosclerotic devastation, the entire molecular layer was remarkably reduced in width, measuring only from one-third to one-fourth of the normal thickness. Cells and nerve fibers were almost entirely destroyed. Scarcely any Purkinje cells or their dendrites were encountered. Glia fibers, especially Bergmann fibers, were greatly

increased throughout the molecular layer. Amyloid corpuscles were seen mostly in the meshes of proliferated glia fibers of the outer border and in the deepest part of molecular layer.

In the intermediate layer a great many fat corpuscle cells came to view when the process was relatively young.

The granular layer and the white substance suffered equally from arteriosclerotic degeneration, causing in the former the disappearance of spheroid cells and in the latter the degeneration of myelin sheaths.

The fatty degeneration of Purkinje cells was also focal, that is, well marked in the lesion or in the immediate neighborhood of the



Fig. 10.—A dendritic swelling from which a great number of finer branches are given off.

lesion, while in remote parts it was barely noticeable. In Case 19 fatty degeneration was general and in a considerably advanced stage, the patient being 92 years of age.

Case 20 presented a peculiar alteration of the cerebellum. The degeneration of the nervous element was so great that within the affected areas all parenchymatous elements had entirely disappeared, leaving only a framework (Fig. 11). In the molecular layer the Bergmann fibers which traversed it were almost the only constituents to be seen, the whole layer appearing like a slat fence. In the intermediate zone the Purkinje cells had almost disappeared. Glia cells

with large nuclei remained and marked the border of the molecular and granular layer. In the granular layer spheroidal cells, Cajal's star cells and other cells of parenchymatous nature had all disappeared. Glia cells and fibers formed a loose network. Here and there, where the devastation was still more complete, one could observe only a cystic cavity with no trace of supporting fibers.

Local swellings of axis cylinders, such as those described for the preceding group, were also encountered. These, however, were not so numerous as in the preceding group. In a small section (about ten folia) from two to five such swellings were found in Cases 17,



Fig. 11 (Case 20).—An atypical form of arteriosclerotic devastation of the cerebellum.

18, 20 and 21, and in Case 19 in from three to four sections of approximately the same size, only one or two swellings were seen. The last case showed an advanced fatty degeneration of the Purkinje cells. As a rule, however, swellings are not usually found associated with markedly degenerated Purkinje cells. Most of the swellings were found far from arteriosclerotic lesions in apparently healthy tissue, as was noticed by Cajal. I could not decide whether some of these swellings represented divided central ends of axons of Purkinje cells. On the other hand, I was able to follow, in a few instances, axis cylinders

with swollen bodies far down into the white substance of the cerebellum.

The association of swellings with relatively healthy Purkinje cells, their location at a distance from the lesion, and the fact that swollen fibers can be followed farther down into the white matter, suggest a reaction in relatively healthy Purkinje cells and fibers.

In Case 17, as shown in Figure 12, a peculiar sort of swelling was observed—two spindle formed swellings connected by a fiber filament, one of them located in the intermediate layer where normal Purkinje cells were found and the other in the granular layer. The upper spindle showed a fine netlike structure, while the lower one presented a coarse network arrangement. Whether or not the upper swelling

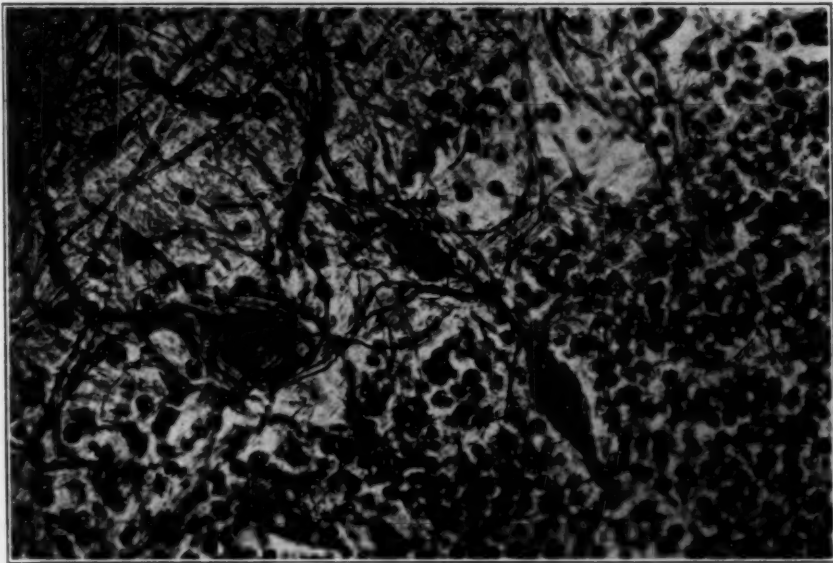


Fig. 12.—Photomicrograph of the cerebellum of the patient in Case 18.

was an atypical Purkinje cell or spindle formed ganglion cell, or a swelling of an apical prolongation from the spindle formed cell of the granular layer, is difficult to determine. The lower swelling might be either a local hypertrophy of a fiber, or it might be a cell body; but in any case, one of them was a structure of the type with which we are dealing. Swellings of fibers of unknown origin were found not only in the granular and the intermediate zones, but also in the molecular layer.

The dendrites of Purkinje cells were greatly affected within areas of lesions, but outside of them they were generally in fair condition. Case 21 presented a general scarcity of dendrites. The peculiar swellings of dendrites were found only in Case 21, and were fairly abun-

dant, being of many forms. A good example of Type 5 (described in the preceding group) was observed (Fig. 13). The ends of two dendrites were encountered which had the appearance of balls from which many very fine branches radiated. This condition suggested a regenerative rather than a degenerative process. The swollen or globular part was diffusely stained by silver. It did not contain any fatty substance. In other types of dendritic swellings a fatty substance



Fig. 13.—A type of dendritic swelling observed in Case 21. The ends of two dendrites show a ball-like swelling from which a number of finer branches are given off.

could be demonstrated, as well as a homogeneous semiliquid substance of an argentophilic character.

GROUP III. GENERAL PARALYSIS

CASE 22 (Case No. 19518, Aut. No. 1938).—Male; admitted at the age of 45; blood serum and spinal fluid positive; died two weeks after admission; cause of death was given as general paralysis.

CASE 23 (Case No. 18784, Aut. No. 1931). Male; admitted at the age of 48; fifteen years ago was infected with syphilis; blood serum and spinal fluid reactions positive. He died one year after admission to the hospital from lobar pneumonia.

CASE 24 (Case No. 18029, Aut. No. 1909).—Male; admitted at the age of 38; Wassermann reaction on blood serum and spinal fluid positive; died of bronchopneumonia after being in the hospital two years.

CASE 25 (Case No. 19395, Aut. No. 1924).—Male; admitted at the age of 39. He was admitted to this hospital eight years ago for the first time; at that time tests on spinal fluid were positive. He was admitted after eight years; died from general paralysis.

CASE 26 (Case No. 19091, Aut. No. 1971).—Female; admitted at the age of 51. Blood serum and spinal fluid reactions were positive; died one year after admission from general paralysis.

CASE 27 (Case No. 18681, Aut. No. 2030).—Male; admitted at the age of 60. Blood serum and spinal fluid reactions were positive; death at the age of 62 from general paralysis.

Pathologic Observations on Group 3.—The pia mater was thickened, its vessels being infiltrated by lymphocytes and plasma cells. The glia network of the outer border was considerably increased. The molecular layer was reduced in width, the structural plan being greatly altered. Tangential fibers and cushion fibers were diminished. The amyloid corpuscles were markedly increased; they were found, not only in the molecular, but also in the intermediate and granular, layer. Fat corpuscle cells were found around the infiltrated vessels in all layers. In the granular layer spheroidal cells were markedly diminished in number, especially in Cases 22 and 26. In the white substance there was a marked pallor of the myelin sheaths due to diffuse degeneration of fibers. Glia cells were increased in all layers, particularly at the outer border of the cortex, in the intermediate zone and in the granular layer. Glia fibers, as well as glia cells, were markedly increased, especially the Bergmann fibers.

The apical dendrites of the Purkinje cells tended to stain intensively and could be traced a greater distance than in the normal cerebellum. In Cases 22 and 26 the lipoid substance in the Purkinje cells was enormously increased; there was more of this substance even than was found in the most advanced cases of senile dementia. The Nissl bodies had disintegrated into a granular or dustlike substance. The nuclei of the Purkinje cells displayed various changes. They were mostly irregular in form and showed a dark stained nucleolus surrounded by a dark chromatin substance arranged in the form of a wreath.

All cases in this group displayed axonal swellings, but not so numerous as in the cases of senile dementia. These swellings were more numerous in Case 24. The character of the swollen bodies was the

same as that of the swollen bodies described in the cases of senile dementia. There was, however, less variety; most of the swellings were spindle or conical shaped.

Dendritic swellings were also observed in Case 22. In addition to localized swellings a few dendrites showed diffuse hypertrophy, with increased staining quality and with a loss of the neurofibrillary structure. The swellings of the dendrites, mostly spindle or bulb form, contained fatty substance, which was readily stained by Scharlach R. Not only the localized swellings of the dendrites, but also diffuse hypertrophic dendrites contained fat corpuscles. The dendrites in this case (Case 22) seem to have suffered more intensively from degenera-

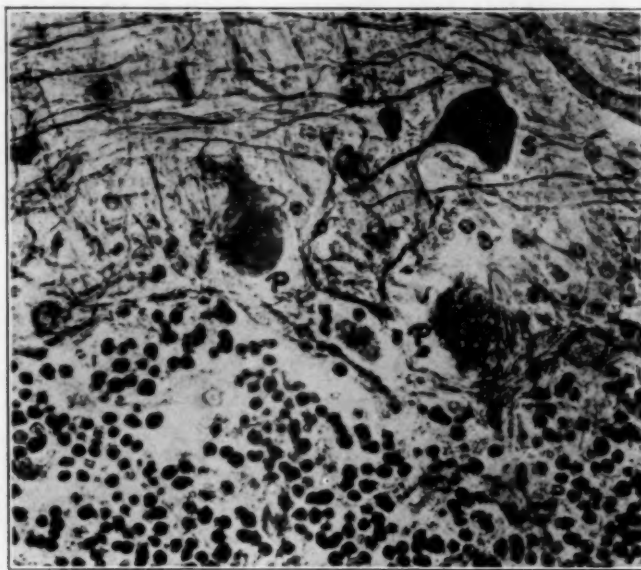


Fig. 14.—S, a swelling of a fiber whose origin is unknown; P, a Purkinje cell.

tion than in the remaining cases. Thus the swellings of dendrites appear to have a definite relationship to the general degenerative changes in dendrites. This may explain why dendritic swellings were found only in this case, for only in this case were general dendritic changes marked.

In Case 27 a few swellings of fibers were observed in the molecular layer in the immediate neighborhood of the Purkinje cells, but the cells of origin for these fibers were not determined. These swellings, however, may be fibers from spindle form ganglion cells of the granular layer, axons or collaterals of Purkinje cells, or dendrites given off from the sides of the Purkinje cell body, for I believe that any of these may show swellings of this sort (Fig. 14).

GROUP IV. CONGENITAL BRAIN DISEASES

CASE 28 (Case No. 16295, Aut. No. 2101).—Female; preceding the mental disturbance which occurred eighteen years ago, the patient had a "shock" following aphasia which lasted eight weeks. She died eighteen years after onset. Cause of death was given as chronic valvular disease.

CASE 29 (Case No. 19837, Aut. No. 2004).—Male; 8 years of age on admission; blind when admitted. He was untidy; he made no attempt to respond when questioned. He died eight months after admission; the cause of death was marasmus.

CASE 30 (Case No. 18551, Aut. No. 1999).—Male; admitted at the age of 62. The patient went to school but could not learn to read and write. He was classified as an imbecile. He died of tuberculosis.

Pathologic Observation on Group 4.—Case 28 was previously reported by the writer as a case of diffuse cerebrospinal sclerosis. The brain was small, weighing only 870 gm., and was unusually firm in consistency. Histopathologically, a considerable increase of glia cells throughout the whole central nervous system was shown. Myelin sheaths in the centrum semi-ovale were diffusely degenerated. In addition to these remarkable changes, there was a cyst in the anterior part of the centrum semi-ovale of the right side, surrounded by softened areas.

The cerebellum presented also a considerable increase of glia elements in all cortical layers and in the white matter. The nuclei of glia cells displayed all possible varieties. In the Purkinje-cell layer abnormally large, irregularly shaped, nuclei of glia cells were observed. Rod cells were abundantly encountered in the white matter. Glia fibers also were increased. The glia belt of the outer border was enormously thickened. The Bergmann fibers were prominent. Heterotopic cells, from two to three in a few sections, were observed in the upper portion of the molecular layer.

I include this case within the congenital group on account of the abnormally small brain, simple convoluted pattern, heterotopy of Purkinje cells and some anomalous organs of the body.

Case 29 showed microscopically no characteristic findings of amaurotic family idiocy, which would be expected from a reading of the history. Ganglion cells of the cerebrum showed well marked fatty degeneration. Dendrites of the ganglion cells, however, were not swollen. Glia cells were increased both in the cerebrum and cerebellum. The cause of the blindness was not determined, nor could we determine whether it was of central or peripheral origin. As there were a number of anomalies and malformations in the central nervous system, as well as in the body, this case was classified in the congenital group.

Case 30 did not show any chronic inflammatory processes of the meninges and brain substance. The brain was relatively small (1,050

gm.), and the gyri were of a simple pattern. The evidence which points to the congenital nature of the case is not so good as in the preceding two cases.

In Cases 28 and 29 tangential and cushion fibers showed some diminution. The Purkinje cells were perceptibly reduced in number. Apical prolongations stained unusually well, while Nissl bodies showed a granular disintegration and disappearance, especially in the peripheral and apical portions. With the exception of a slight diminution in the number of Purkinje cells, Case 30 showed no remarkable changes either in the cells or in the fibers.

All these cases showed axonal swellings. The first two cases displayed abundant examples of swelling, while the last case exhibited few swellings. Most of the swellings were of the spindle form; other types were rarely encountered.

Dendritic swellings were observed in the first two cases; they were abundant in Case 29 (Fig. 15) and less abundant in Case 28. Most of the spindle form swellings occurred in secondary or in tertiary branches. They were markedly argentophilic and showed no neurofibrils. In Case 29 the swellings were encountered chiefly in dendrites given off from the sides of the cell body or in one of the secondary branches of less thickness. This condition was also observed in some of the cases of the senile group.

GROUP V. DEMENTIA PRAECOX

CASE 31 (Case No. 19440, Aut. No. 2007).—Female; age on admission 40; hallucinated; indifferent, lost interest in her work; at times refused food and medicine; died of bronchopneumonia after being in the hospital about a year.

CASE 32 (Case No. 20069, Aut. No. 2112).—Female; admitted at the age of 32, with ideas of persecution; hallucinated; indifferent and untidy. She died at the age of 33. Cause of death was given as exhaustion.

CASE 33 (Case No. 20403, Aut. No. 2051).—Female; admitted at the age of 32; unclean and hallucinated; disoriented. The Wassermann reaction on the blood serum was positive; spinal fluid reaction was negative. She died of mitral disease at the age of 34.

Pathologic Observation on Group 5.—No remarkable histopathologic changes were observed in cases of this group. In Case 31 there was a slight diminution of Purkinje cells at the summit of the folia. The amyloid corpuscles, in comparison with the other two cases, were slightly more numerous at the outer border of the cortex and in the deeper part of the molecular layer. The Purkinje cells were apparently normal in appearance, the finer architecture well shown. No swellings of either axons or dendrites could be demonstrated in any of these cases.

GROUP VI. MANIC DEPRESSIVE CASES

CASE 34 (Case No. 18081, Aut. No. 1993).—Male; admitted at the age of 49. He had two attacks of depression. He was apprehensive and had a tendency toward suicide. Two and a half years after admission he died of septicemia.

CASE 35 (Case No. 20058, Aut. No. 2015).—Female; admitted at the age of 51; agitation, extremely restless and resistive; flight of ideas. She died from general streptococcic infection two weeks after admission.

CASE 36 (Case No. 19918, Aut. No. 2017).—Male; admitted at the age of 45; depressed. He died three months after admission. Cause of death was given as arteriosclerosis.



Fig. 15.—Spindle form swelling of a dendrite in Case 29.

Pathologic Observation on Group 6.—No remarkable histopathologic changes were found in these cases, with the exception of the changes in the Purkinje cells in the first two cases. In these cases a great many Purkinje cells had undergone a remarkable alteration. The nuclei, as well as protoplasm, stained poorly. The nuclear membrane had partly disappeared. The Nissl bodies were chromatolytic at the center, as well as at the periphery, of the cell. These changes of the Purkinje cells may possibly be associated with the terminal condition of the patients, who in both cases died of acute infectious diseases.

In none of these cases were the peculiar swellings of the axis cylinders and dendrites observed.

GROUP VII. ALCOHOLIC AND TOXIC CASES

CASE 37 (Case No. 9229, Aut. No. 1966).—Male; admitted at the age of 46 with a definite history of alcohol and attacks of delirium tremens. He died of lobar pneumonia after eighteen years in the hospital.

CASE 38 (Case No. 20036, Aut. No. 2067).—Male; admitted at the age of 50; definite history of alcohol. He died eleven months after admission of tuberculosis.

Pathologic Observation on Group 7.—The changes were marked and of the same character in both of these cases. Glia cells and glia fibers were slightly increased. The walls of the vessels displayed more or less fatty degeneration. Fat corpuscle cells were abundantly observed in the intermediate cell layer. The Purkinje cells were somewhat diminished in number, showing a marked increase of lipid substance. Apical dendrites were rather deeply stained and could be traced for a considerable distance. The nuclei of the Purkinje cells showed some contraction and irregularity in form. The Nissl bodies had disintegrated. The tangential and cushion fibers seemed to be slightly diminished in number. Fat corpuscle cells were observed in the granular layer and in the white substance.

Swellings of the axis cylinders were observed in both cases, one or two in three or four sections. These were all spindle shaped and diffusely argentophilic.

Dendritic swellings were observed in Case 37. The swellings were spindle shaped or pedunculated. In Case 38 swellings of some fibers whose origins could not be identified, were found in the molecular layer not far from the Purkinje cells.

GROUP VIII. BRAIN TUMORS

CASE 39 (Case No. 21305, Aut. No. 2110).—Male; admitted at the age of 49; died ten days after admission.

CASE 40 (Case No. 20818, Aut. No. 2087).—Male; aged 50 on admission; aphasia; headaches with vomiting and vertigo.

In both cases the tumors were found to be gliomas. In both cases the cerebellum was flattened as a result of an increased intracranial pressure. Macroscopically, the cerebellar folia were generally flattened. Microscopically, the molecular layer was seen to be diminished in thickness, particularly at the summit of the folia, which gave them the appearance of a xiphoid process.

The most remarkable changes in this group were those in the dendrites of the Purkinje cells which coursed in a zigzag or serpentine manner (Fig. 16). Most of the finer dendritic branches had disappeared. The apical dendrites showed exceptionally good staining qualities. The Purkinje cells, basket and cushion fibers suffered very little. There was also a slight increase of glia cells and fibers.

The axis cylinders of the Purkinje cells disclosed the peculiar changes with which we are dealing. No dendritic swellings were observed.

GROUP IX. MYXEDEMATOUS PSYCHOSIS

CASE 41 (Case No. 21477, Aut. No. 2125).—Female; admitted at the age of 66. On admission she showed typical symptoms of myxedema. She died one month after admission. Cause of death given as myxedema.

Pathologic Observation on Group 9.—The ganglion cells of the cerebrum of this case showed cell changes due to a myxedematous condition of the brain matter. I have previously reported this case,

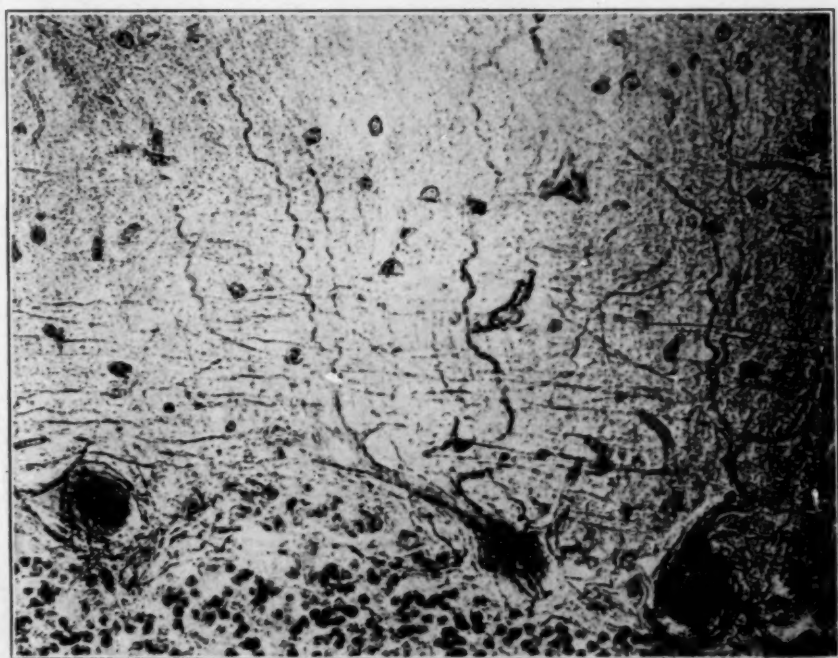


Fig. 16.—Serpentine course of dendrites due to pressure of the cerebellar cortex.

calling special attention to this type of cell change, which is believed to be pathognomonic for this disease. The Purkinje cells did not show this peculiar change. In the cerebellum the changes were very much like those of arteriosclerosis. The glia cells and fibers were increased. Fairly abundant amyloid corpuscle cells were found in the deeper portion of the molecular layer. The Purkinje cells contained only a moderate amount of fatty substances.

The peculiar swellings of axis cylinders, two or three in a section, were found. There were also some swollen fibers of obscure origin in the neighborhood of Purkinje cells.

SUMMARY AND CONCLUSIONS

The peculiar swellings of the axis cylinders and dendrites have been observed in various groups of diseases more commonly than was anticipated from a study of literature. These peculiar changes can, therefore, no longer be considered as specific changes. They are encountered in cerebella whenever there is a chronic degenerative process. This process may be either of an inflammatory character, the result of malformation, or of toxemia, as for example, from alcohol.

GROUPS OF CASES STUDIED, WITH THE PERCENTAGES OF AXONAL AND DENDRITIC SWELLINGS

Groups of Diseases	Cases Studied	Axonal Swellings	Percentage of Axonal Swellings	Dendritic Swellings	Percentage of Dendritic Swellings
Senile dementia.....	16	16	100	14	87.5
Arteriosclerosis.....	5	5	100	1	20.0
General paralysis.....	6	6	100	1	17.0
Congenital.....	3	3	100	2	66.7
Dementia praecox.....	3	0	0	0	0.0
Manic depressive.....	3	0	0	0	0.0
Alcohol, toxic.....	2	2	100	1	50.0
Brain tumors.....	2	2	100	0	0.0
Myxedema.....	1	1	100	0	0.0
Total.....	41	35	85	19	46.0

Axonal swellings are more frequently observed than dendritic swellings. Axonal swellings may be found in any disease in which the Purkinje cells have undergone degeneration. If, however, degeneration of the Purkinje cells is extreme, axonal swellings are either not to be observed or only a few are encountered as these swellings are stages of degeneration which these cells undergo. The dendritic swellings, on the other hand, are found even with fairly advanced degeneration of the finer dendritic processes and most commonly in senile dementia and congenital brain diseases. The dendritic and axonal swellings are not always of the same intensity in the same case though they are usually associated (Plate 2, Fig. 3).

What is the nature of these peculiar changes? Are they regenerative or degenerative in character? The swellings of the axis cylinders are not necessarily at the points of division of an axon by injury, although some swellings have no fiber continuing from them. From most of the swellings, however, a fiber may be followed down into the white matter. In cases which displayed coarse lesions, such as cystic cavities in the granular layer, the peculiar swellings were not found in the immediate neighborhood of the lesions but at a distance from the latter. Moreover, the swellings, as mentioned in the foregoing, have always been observed at a short distance from the Purkinje

cell body and always in the upper part of the granular layer. This fact and also the fact that the swellings are always associated with somewhat pathologic but not extremely degenerated Purkinje cells, lead to the assumption that the swellings are, in the beginning at least, a reactive process of pathologic but living protoplasm. The diffuse hypertrophy of axons and collaterals, which are found associated with focalized swellings, are to be regarded as a regenerative process. Thus the ill-nourished or slightly degenerating Purkinje cells appear to make a feeble attempt to increase the thickness of the axons. This increase of thickness may be, as Schaffer has asserted, the result of an hypertrophy of the axoplasm.

The "feeble attempt" at regeneration is, however, abortive. The Purkinje cells themselves, in diseases in which we find these peculiar changes, undergo degeneration, and their axons soon suffer a further process of a degenerative nature. This is expressed by the localized swellings of the axons caused by the accumulation of waste products of pathologic metabolism. The markedly argentophilic character of the swollen bodies, formation of vacuoles and deposition of fatty substances in the swellings, indicate the degenerative character of this phenomenon.

The dendritic swellings, though they are not so frequently observed as axonal swellings, probably are of the same character. Here I observed clearly that the dendritic stumps showed irregular swellings from which numerous finer branches were given off. This, and the diffuse thickness of the dendrites, leads one to conclude that the nature of the process is regenerative. Bulblike forms, which were found at the ends of thick dendritic fibers, may probably be compared to the central stump of the divided nerves, and are naturally of a regenerative character.

The regenerative process, however, is soon followed, as in the axis cylinders, by a degenerative one. The metabolic product which in most instances gives rise to the peculiar swellings is a homogeneously glassy substance. This substance shows a staining reaction similar to that of the amyloid bodies found in the central nervous system. I have been unable to determine the definite character of this substance. I have not yet arrived at a satisfactory explanation as to why senile dementia and congenital brain diseases are more likely to show this peculiar phenomenon than are other diseases. The inherited predisposition of the nerve element in congenital diseases and the acquired weakness in senile dementia may possibly play a great part.

REPEATED MULTIPLE MINUTE CORTICOSPINAL HEM-
ORRHAGES WITH MILIARY ANEURYSMS IN
A CASE OF ARTERIOSCLEROSIS *

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INTRODUCTORY

Miliary aneurysms were first mentioned by Cruveilhier¹ in his "Atlas," in which he pictured a case of multiple minute hemorrhages similar in pathologic appearance to the condition in the case I shall describe. He reported this condition as a "rare form of capillary apoplexy which consists of small disseminated miliary hemorrhagic foci (apoplexie capillaire a foyers miliaries). In 1851, Virchow² carefully described miliary aneurysms, and in his plates showed that true aneurysms are caused by disease in the coats of the vessels, chiefly the muscular. He differentiated between spindle-form aneurysms which involve the whole vessel wall and sac-like swellings which indicate a weakening on one side only; the latter are much less common. He was able to show all vessel coats extending over some of the ectasias, including the middle or muscular coat—this condition he calls "aneurysmata vera totalia." Furthermore, he showed all degrees of degeneration of the muscle wall in these aneurysms; in some, the muscle coat was entirely gone in spots, leaving only the inner and outer coats.

Calmeil,³ as quoted by Charcot and Bouchard, also noticed them, but did not comment on their nature.

Gull⁴ observed the condition and demonstrated a ruptured miliary aneurysm in a case with cerebral hemorrhage.

Charcot and Bouchard,⁵ in 1868, made careful studies in a series of eighty-four cases of cerebral hemorrhage and applied the term

* From the Pathological Laboratory of the Massachusetts State Psychiatric Institute, 74 Fenwood Road, Boston.

1. Cruveilhier: *Anatomie pathologique du corps humain*, 1835-1842, Liv. XXXIII, Pl. II, Fig. III.

2. Virchow: *Virchows Arch. f. path. Anat.* 3:442, 1851, Plate IV.

3. Calmeil: *Traité de maladies inflammatoires du cerveau*, 1859, T. II, p. 522.

4. Cases of Aneurysm of the Cerebral Vessels, *Guy's Hospital Reports*, Sec. III, T. V., London, 1859.

5. Charcot and Bouchard: *De l'hémorrhagie cérébrale*, *Arch. de Phys.*, 1869, No. 1, p. 112.

"miliary aneurysms."⁶ These observers were the first to point out their frequency as a cause of cerebral hemorrhage. They asserted that miliary aneurysms are most common in the basal ganglia and pons, at which sites Meynert⁷ and Heschl⁸ had noticed them; the next site in order of frequency is the cortex. According to Charcot, they are rare in other parts of the brain.

Ford Robertson⁹ brought out the fact that miliary aneurysms are common in the pia mater; also that it was not true, as Charcot and Bouchard had stated, that all miliary aneurysms were visible by the unaided eye.

Pick¹⁰ showed, in a convincing way, the frequency, disposition and form of miliary aneurysms by his method of washing the gray matter in saline solution or water, leaving the vessel stalks with aneurysmal dilatations plainly visible. He examined, with Ellis,¹¹ about thirty cases. He stated, in his conclusions, that he was unable to demonstrate true miliary aneurysms either as circumscribed ectasias or sac-like forms involving only a part of the vessel circumference. His main conclusion from his examination was counter to the Charcot-Bouchard theory that miliary aneurysms are the cause of fatal cerebral hemorrhage in the great majority of cases. Pick¹⁰ stated that such hemorrhages were due to ruptures of supermiliary aneurysms. He further stated that "neither the dissecting types nor the false aneurysms cause death." He admitted that "miliary aneurysms may rupture and that theoretically the simultaneous rupture of many of them might cause death. But there is no evidence of this."

More recently miliary aneurysms have been studied by Shennan,¹² who, in one of his cases, was able to show the lenticulo-striate artery well bedecked with aneurysmal dilatations in the hemorrhagic hemisphere, and the same vessel remarkably free of ectasias on the non-hemorrhagic side. He also found large fusiform ectasias—larger than miliary—probably the supermiliary forms, whose rupture Pick is willing to admit as an adequate etiologic factor in fatal cerebral hemorrhage.

6. Cruveilhier, as mentioned before, had already used the designation "miliary."

7. Meynert: Ueber Gefässentartungen in der Varolsbrücke und den Gehirnschenkeln, Allg. Wien. Wchnschr., 1864, 28.

8. Heschl: Die Capillar-Aneurysmen im Pons Varoli, Wien. med. Wchnschr., Sept. 6, 1865.

9. Robertson, Ford: Pathology of Mental Diseases, Edinburgh, 1900, p. 150.

10. Pick, L.: Ueber sogenannten miliaren Aneurysm der Hirngefässe, Berl. klin. Wchnschr. 47:325, 1910.

11. Ellis, A. G.: Pathogenesis of Spontaneous Cerebral Hemorrhage, Proc. Path. Soc., Philadelphia 12:197, 1909.

12. Shennan, T.: Miliary Aneurysms in Relation to Cerebral Hemorrhage, Edinburgh M. J. 15:245, 1915.

Opinion, therefore, is divided as to the degree in which miliary aneurysms are a factor in causation of lethal brain hemorrhage. Charcot and Bouchard asserted that a great majority of such deaths were due to miliary aneurysms. Pick said that few, if any, deaths were caused by ruptured miliary aneurysms.

We believe the following case supports the latter view, for there is evidence of repeated showers of miliary hemorrhages with recovery in each instance in spite of an extremely high blood pressure, except in the last instance, in which death was due to intercurrent disease.

REPORT OF A CASE

History.—Patient No. 18905, at the Boston State Hospital, was an Irish steamfitter, 59 years old at the time of his death. He had been regular in habits, a steady workman and supported his family adequately. He had used alcohol but not excessively; he had used none for the last ten years. He had always been well.

A transient convulsion in August, 1916, when 57 years of age, followed by residuals, ushered in the present trouble. Since that time, a progressive amnesia with repeated attacks of vertigo and seizures at irregular intervals from two weeks to three months had been evident. He complained frequently of headache. During the seizures his face was flushed and generalized clonus was the rule, but there was no frothing of saliva.

In March, 1917, he was treated in a hospital (having been taken there after a convulsion on the street) for "high blood pressure." On April 25, he awakened groaning with a "fearful headache." He became blind and was seized by a convulsion followed by unconsciousness lasting seven hours. Anopsia continued a few hours longer. By the end of the second day he had recovered but still suffered from a headache. On the third day, he was confused and hallucinated (heard lumber falling). He was disoriented, and observation at the Psychopathic Hospital was advised by his physician. He was admitted on April 27, 1917.

First Physical Examination.—Examination of the chest and abdomen was negative, and the patient was well developed and well nourished. The blood pressure was: systolic, 230; diastolic, 160. Sclerosis of the superficial vessels and some speech defect focused the attention on the nervous and vascular system; and unequal knee jerks, a sluggish pupil (iridectomy in the other eye) together with a slight tremor of the tongue still further accentuated the interest. The urine examination was negative, and the renal function was only slightly impaired (50 per cent. in two hours, according to the phenolphthalein test). The spinal fluid contained globulin 1, albumin 2, cells 1; the colloidal gold curve was 3333332100, but the serum and fluid Wassermann tests for syphilis were negative.

First Mental Examination.—The patient was completely disoriented the first few days, but his mind became clear and he was then correctly oriented. His memory for recent events was defective, but he gave a fair account of his life, talked intelligently when not confused and had a fair grasp on surroundings. His personal appearance showed a careless attitude, though he probably had some insight into his condition. In ten days he went home improved, though still slightly confused and amnesic.

Second Admission to the Hospital.—He was returned to the hospital eighteen months later. During this time he had frequently been brought home by the police, being found in convulsions on the street; these occurred at almost biweekly intervals. One morning he awoke with numbness in the right arm and on the right side of the head. This numbness remained in the fingers after sensation had returned in the arm and face.

Second Physical Examination.—When examined at the Psychopathic Hospital, Oct. 24, 1918, he showed no physical change since the previous examination with the exception of a slight rise in blood pressure, which was systolic, 250 and diastolic, 160. On first admission the blood pressure was systolic, 230; diastolic, 160. The vessels were thickened and sclerotic as before, and the pulse full, regular and of high tension, though the urinalysis was negative, as were also the Wassermann and tuberculosis complement fixation tests of the blood serum. Nervous System: Pupils: There was coloboma in the left eye due to an old injury; the right eye was small and irregular and reacted in a small radius. Fundi: The retinal vessels were tortuous and showed considerable variation in size. The veins were deeply depressed and presented a silver wire appearance. Knee Jerks: The reflex on the left side was sluggish; the right reflex could not be obtained. The arm, abdominal and cremasteric reflexes were normal. There was no disturbance of the special senses or of the deep or cutaneous sensations; there were no tremors of the head, fingers or tongue, which protruded centrally.

Mental Status: When admitted the second time, the patient was quiet, pleasant and cooperative. He stated that it was 1873 (1918), and that he had never been at the hospital before. His wife stated that he had been irritable and unreasonable and had quarreled with all his relatives. He denied this in general, but admitted a "few arguments recently." His memory was poor and somewhat patchy, but better for the distant past; his judgment was defective. He attributed his present trouble to "high blood pressure," which "makes him irritable"; in this he showed partial insight. He displayed slight emotional exhalation, and though he had no delusions or hallucinations he seemed to have some difficulty in thinking and in expressing himself, but there was no motor speech defect.

Two days later he was oriented for place, shortly after talking freely and appearing to be happy, but that same night he became excited and smashed windows, sustaining several small glass cuts on hands and forearms. After this episode he was restless and confused and incoherent in explaining his conduct; he thought the police were pursuing him and that they must have wished to make a "damn fool of himself." The patient was exceedingly restless and noisy during the entire night and felt exhausted next morning. October 30 aphasia was noticed: Door was called "chair," the bandage on his hand a "spoon." He stated that he knew the articles but "cannot tell them." Later in the same day he became excited, rushed about the ward and became violent when attempts were made to control him. He had ideas of persecution and sought windows and doors in attempts to elude pursuers. The next day and for two weeks he was more quiet and rational but his mind was not entirely clear; then he had a convulsion of short duration. These convulsions occurred occasionally during the next six weeks, and he was in bed most of the time, took little interest in his surroundings and was markedly confused.

Jan. 25, 1919, he frequently sank into a lethargic state from which it was difficult to arouse him, though he was lying with his eyes open. He was aphasic and very amnesic. He had a convulsion lasting twenty minutes, followed by great confusion.

Two weeks later, Feb. 14, 1919, his temperature rose to 100 F., the next day it was 98.6 degrees. He was semicomatose; he could be aroused but soon reverted to lethargic state. Ten days later his right arm was spastic; it flexed at the elbow and wrist. Spasticity was present in the right leg. Knee jerks were absent as were also abdominal and cremasteric reflexes; and while there was no ankle clonus, there was a right-sided Babinski reflex.

March 6, 1919, the patient showed signs of circulatory retardation, both general and pulmonary. He remained comatose for four days and died on March 10.

Summary.—A man, aged 59 years, died after two years of untoward vascular symptoms, beginning with convulsions. He complained of headache; his relatives noticed irritability; and he was irregularly confused, disoriented, aphasic and amnesic. His blood pressure was high, from 230 to 250, systolic and 160, diastolic, but the heart and urine were normal. The reflexes gradually became unequal on the two sides, and evidences of brain involvement during the last six months presented themselves in increasing numbers of convulsions and confused periods, terminating in lethargy, coma and death.

Postmortem Examination.—The postmortem examination was made by Dr. M. M. Canavan fifteen hours after death. The body was that of a slender, poorly developed and nourished white man, 162 cm. in length. There were small superficial decubitus over the trochanters and sacrum. Rigor mortis was absent. The pupils were unequal; the diameter of the right pupil was 1 mm.; that of the left, 5 mm. There was coloboma of the left eye. The heart weighed 310 gm. The coronary vessels were prominent, sclerosed and constricted, but not occluded. The mitral and aortic valves were thickened. The heart muscle was firm. The lungs were congested; focal edema was present. No pneumonic processes were found. About 250 c.c. of sanguineous fluid were found in the left pleural cavity. The liver weighed 1,275 gm.; it was grayish-brown. The capsule was thickened. The lobules were distinct. The kidneys weighed 110 and 90 gm., respectively. The fibrous capsule was thickened and adherent. The pyramids were small and white. The cortex was grayish-white and 5 mm. deep. The vessels were thickened. Later microscopic examination showed marked hyaline degeneration of the tufts and small vessels. The lymph nodes at the head of the pancreas were enlarged. There was a duodenal ulceration 2 cm. by 0.8 cm. just below the pyloric ring. Marked sclerosis and tortuosity of the splenic artery were found. The aorta contained several medium-sized plaques of thickening, but not to a marked degree.

Calvarium, Brain and Cord: The inner table was smooth with the exception of depressions for pacchionian bodies and grooving for meningeal arteries. The dura was not adherent. The brain weighed 1,595 gm.

Brain: The second nerves were flat and slightly gray near the cerebral arteries. The third and fourth nerves were caught in thickened pia mater. The vessels were evenly white with yellow patches. There were fusiform aneurysmal dilatations of the vertebrals and of the posterior cerebellar arteries. The temporal, left frontal and hippocampal regions were liberally peppered with minute black and brownish-red circular areas, not larger than 1 mm. These were found to be minute hemorrhages. Near the pons on the right side was a linear cyst of softening, measuring 2 by 0.3 cm. The occipital pole on the right was flattened.

The superior surface of the brain showed slightly thickened dura and pia. The arachnoid was thickened along the vessels, which were themselves thick-

ened diffusely and focally. The same minute hemorrhagic spots appeared on the superior surface of the brain, particularly over the vertex. The convolutional pattern was fairly complex; there was scarcely any atrophy. The convolutions in the left hemisphere appeared to be somewhat flattened out and slightly larger than in the right hemisphere. The brain was firm throughout.

The Spinal Cord: This was softer and flatter than usual and at one point in the thoracic region, on section, a translucent area was seen surrounding the central canal (syringomyelia may have been present). In various sections small hemorrhages similar to those found in the cerebral hemispheres were plainly visible to the naked eye.

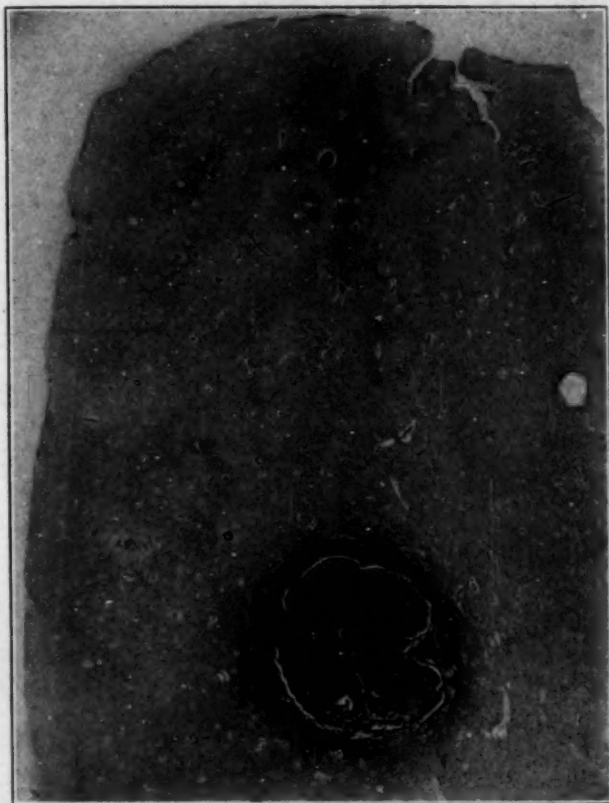


Fig. 1.—Recent hemorrhage from ruptured miliary aneurysm.

CROSS SECTIONS OF BRAIN

Over the convexity of the cerebral hemispheres numerous black spots from 1 mm. to 2 mm. in diameter showed evidence of recent hemorrhage. These areas stood out in even bolder contrast on the base, e. g., on the left hippocampal gyrus. In other instances the rupture and hemorrhage occurred more deeply in the cortex and was either faintly visible or entirely unseen from the surface.

These hemorrhagic areas could be divided into three classes; first the black, sharply demarcated spots; second, the less distinctly circumscribed faded yellowish-brown colored areas, and third, areas in which the brain substance appeared to be softened, less translucent and sometimes replaced by small cystic degenerations.

The first class included lesions of a recent date in which the blackish blood clot was sharply demarcated.



Fig. 2.—Cross section of an unruptured miliary aneurysm showing variation in loss of coats of vessel wall. Stained by Mallory's connective tissue stain.

In the second class were included the hemorrhages of longer standing, in which the disintegration of blood clot was shown in various progressive stages with fading and dissipation of blood pigment into neighboring tissue (Fig. 3).

The third class showed the end result. Pigment was no longer present, but in place of the areas of hemorrhage were found areas of softening, degeneration and, rarely, small cysts.

Most of the lesions were seen in the cortical gray matter but there were also some in the white matter. In the cerebellum the process was commonly in the white matter. In almost all these instances the hemorrhage occurred near either the internal or external surface, and rarely were the lesions deeply embedded. This may have been due to lessened resistance near the surfaces and greater support where the brain substance more completely surrounded the vessel.

EXAMINATION OF CORTICAL VESSELS

Blocks from various parts of the cortex were macerated in water, according to Pick's method.¹³ This brought most fruitful returns: the small vessels of the pia and branches dipping down into the cortex were found to contain numerous aneurysmal dilatations, fusiform, and sac-like; in some cases the small arteriole presented a moniliform appearance. It was found that in the hemorrhagic areas the aneurysms were innumerable. However, interval areas showed little aneurysmal formation and often several pial vessels were followed with no findings.

A favorite location was at the bifurcation of an arteriole, the entering vessel and one or both of the exit vessels showing irregular fusiform dilatations for a short distance. The size varied from 0.4 mm. to 0.9 or 1 mm., rarely larger; when the size was larger it was not much over 1 mm.

MICROSCOPIC EXAMINATION OF HEMORRHAGIC AREAS

The Recent Lesion.—Microscopic appearance of the various stages of resorption of the hemorrhages revealed the following: Vessels dilated and stretched beyond their normal caliber were present in the cortex in the neighborhood of small hemorrhages (Figs. 2 and 6). The amount of bleeding varied from the extravasation of a few cells to a small hematoma 1 mm. in diameter. In recent lesions hardly any reaction was visible. Gliosis was often present, not as a result of this, but probably on account of irritation due to malnutrition in the region of these thickened and athero-sclerotic vessels. By the Sharlach R. method fat, as a very early reaction, could readily be demonstrated in the area whose blood supply had been restricted. Later, blood pigment

13. The material had been hardened for several months, and in order to prepare it for this procedure, blocks were put in 1 per cent. sodium hydrate solution until softened—about three weeks. The vessels could then easily be separated and the branches dipping perpendicularly into the cortex from the pia would stand out stiffly showing clearly their relations.

appeared in abundance. The blood pigment was also frequently attached to ganglion cells and found free in the brain structure in large quantities.

The Old Lesion.—Destruction of the brain cell elements with neuroglia infiltration was seen in spots throughout the cortex. A lacy, open-work appearance showed the result of the previous lesion. Fragments of the vessel wall could still be seen, as shown by Van Gieson's

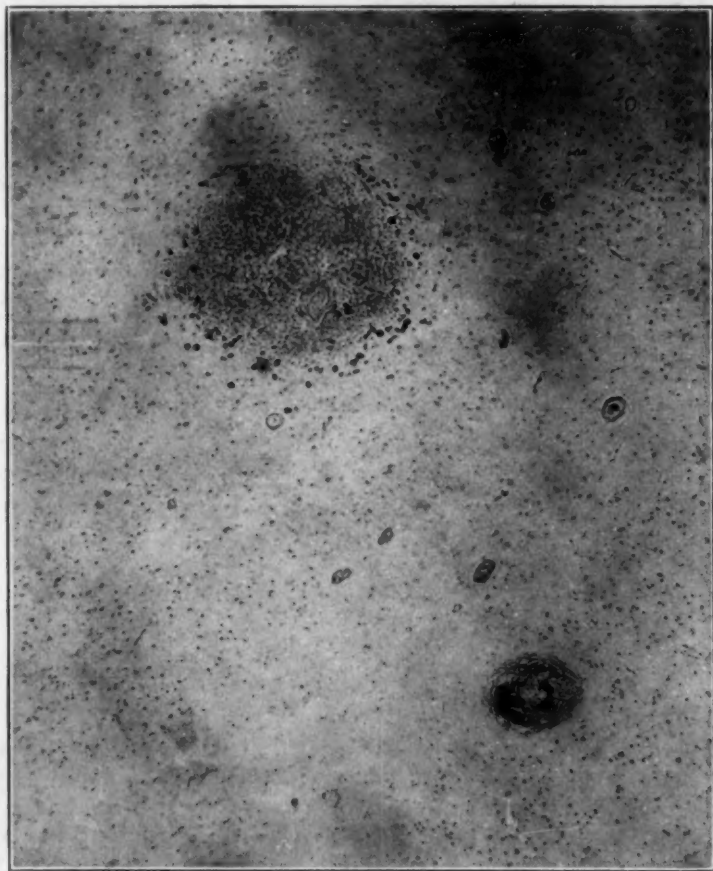


Fig. 3.—Site of old miliary hemorrhage showing pigment-laden phagocytes.

or Mallory's anilin blue stain, entwined by neuroglia fibrils. Active succulent glia cells were found in larger or smaller numbers in nearly all lesions. In myelin sheaths prepared by Weigert's method, a strand of degenerated fibers like the tail of a comet was often found in the wake of an old cortical hemorrhage (Fig. 6). It cannot be stated that all these lacy areas of gliosis were the end product of actual hemorrhage. An obliterative endarteritis seems to have been responsible, in

the cases of many of the smaller foci, for various degrees of endarteritic thickening; even obliterations without determinable hemorrhage were seen. Small cysts of softening no larger than 1.5 to 2 mm. were found several times in various parts of the brain.

Fenestrated Membrane (Verhoeff Stain).—In a shallow sulcus between two small gyri, a vessel 0.15 mm. in external diameter with thickened walls was seen, but the coats were readily differentiated. The fenestrated membrane stood out boldly and the nuclei of the muscle fibers in the media were plainly visible. Nearby was another vessel, 0.12 mm. in external diameter, and though the walls were about the same thickness, little differentiation was possible. The three coats were not distinct; while the adventitia could be located, the intima and media were fused: only now and then in the outer part of this fused layer small areas staining more lightly and of granular appearance seemed to indicate degenerated muscle nuclei. The fenestrated membrane was lost. The vessel walls stained more darkly than those of the more nearly normal vessel, and seemed to be composed of a hyaline substance which formed transverse marks (artefacts from cutting) which showed an inelastic quality, resisting the knife for a distance before yielding and producing a ribbed appearance like the cut surface of fresh bread. This dough-like consistency may account for the wide stretching of some of the vessels (Fig. 2). Judged by the number of layers of muscle fibers of which it was still possible to form some opinion by the number of degenerated muscle nuclei, this vessel should have a fenestrated membrane, for smaller vessels with only one layer of muscle fibers to the media distinctly showed the elastic membrane; but no trace of it was seen. It had undergone the same degeneration as the intima and media and had become lost in the fusion of the two. The adventitia also showed diminished nucleation.

In other instances¹⁴ the elastica appeared reduplicated as if free proliferation had occurred. In these cases the intima was also thickened but distinct. The media, however, was not so readily seen. It appeared to have been encroached on by the augmented elastica.

Summary of Microscopic Examination.—All evidence of a chronic arteriosclerosis of the larger and smaller vessels of the brain was found. The vessel changes varied in some instances, but in general seemed to be due to an extensive endarteritis which was in turn responsible for disease in the other coats, notably the muscularis, including the fenestrated membrane. The end results, destruction of brain tissue with gliosis, were seen in all parts of the brain.

Miliary aneurysms were found in foci scattered throughout the cortex. On section, no true "aneurysma totalia vera," such as Virchow²

14. By Weigert's elastica stain.

reported, with all the coats of the artery intact, was found. On the other hand, dissecting aneurysms were numerous—there were hundreds of them. False aneurysms due to local thickening of the coats were also seen, especially in the smaller vessels, but the dissecting variety was the most common. The intima was thickened and torn, the muscularis injured by fatty and later by granular degeneration,

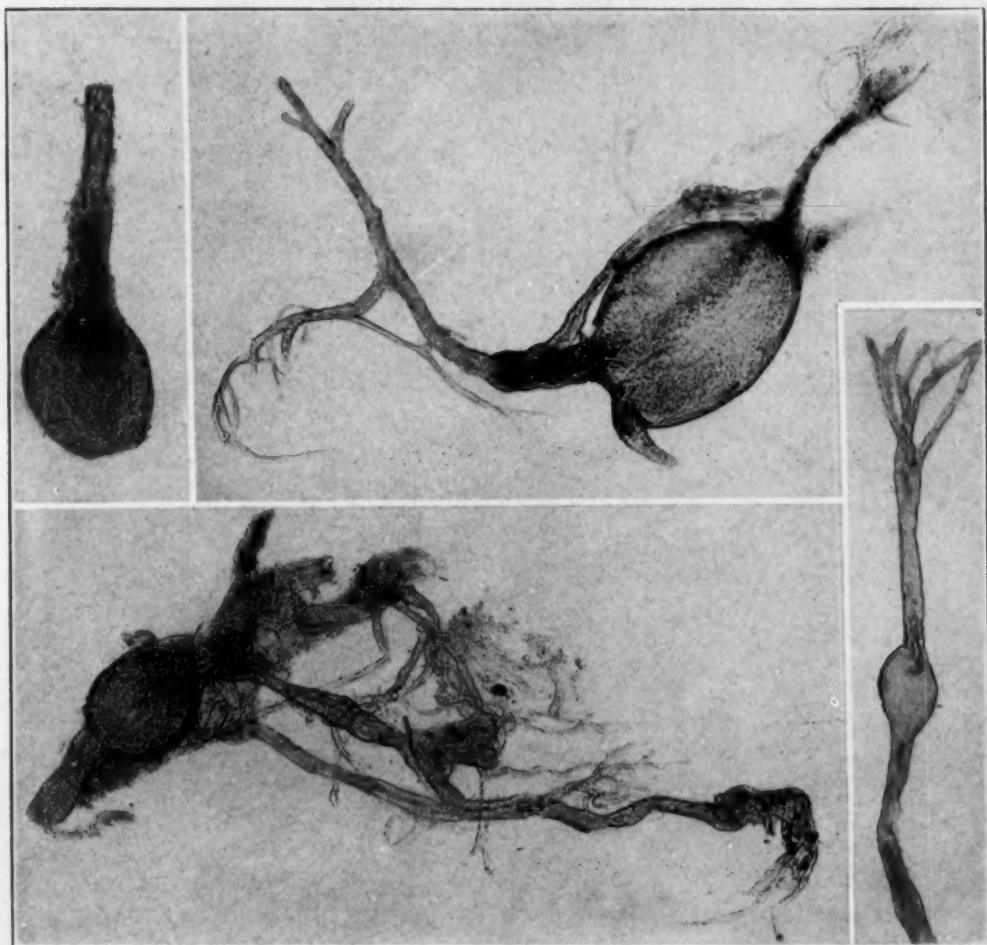


Fig. 4.—Cortical aneurysms dissected out by Pick's method; unstained specimens; \times about 40.

and the elements of the blood had escaped into the intramural spaces, usually lifting the adventitia, thus forming the aneurysmal dilatation. On section, these aneurysms often appeared multilocular, some of the spaces being filled with a thrombus or fibrinous exudate. The lesions were also found in the spinal cord, but much more rarely. Here they

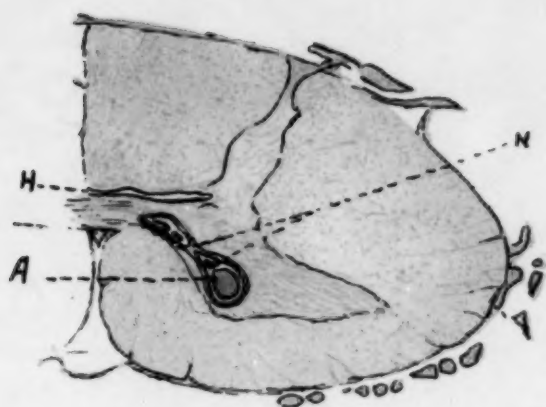


Fig. 5.—Section of lower cervical cord. Dissecting aneurysm at A with thrombus formation. A small channel near the periphery was still patent. N, neurogliosis surrounding dilated vessel; H, slight degree of hydromyelia. Mallory's phosphotungstic acid stain.

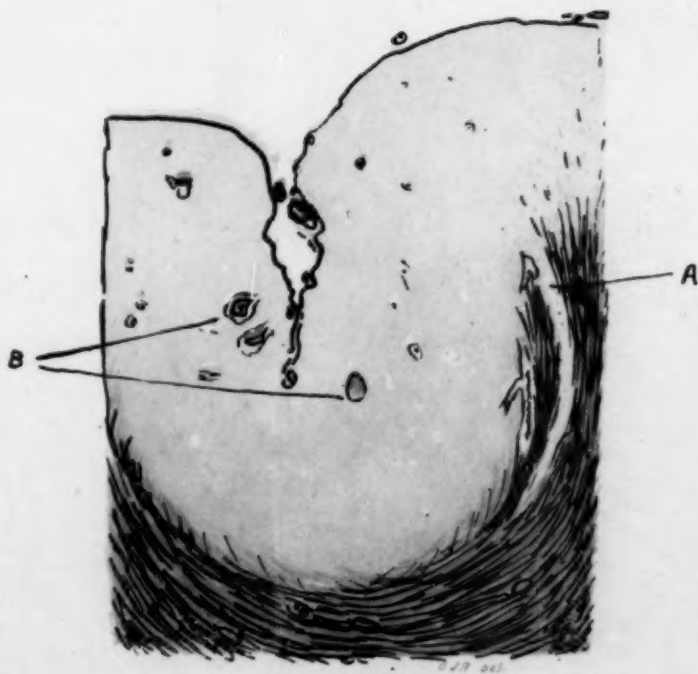
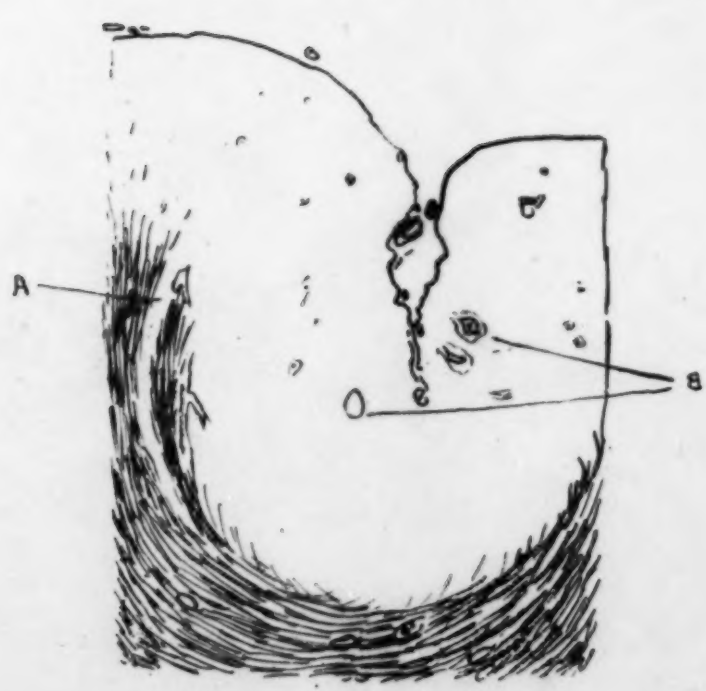
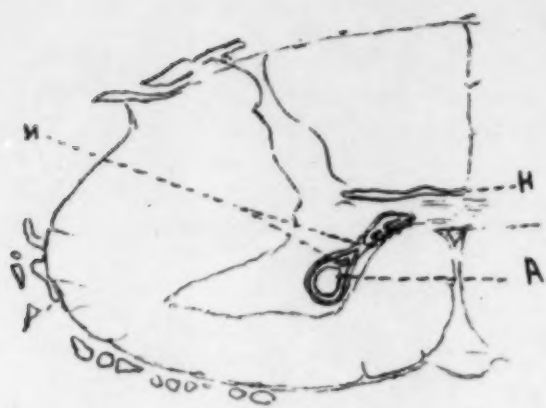


Fig. 6.—Section of right postcentral gyrus; low magnification; Verhoeff stain. A, degenerated tract of fibers in wake of focal cortex lesion; B, thrombosed aneurysmal dilations.



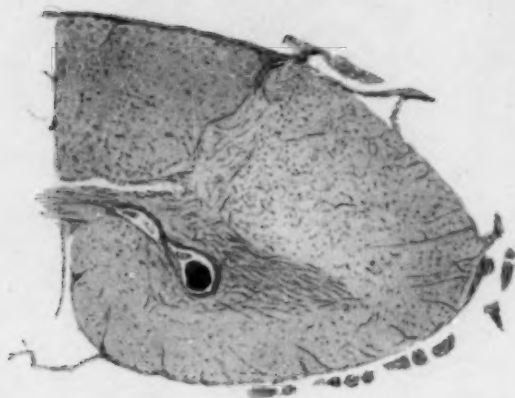


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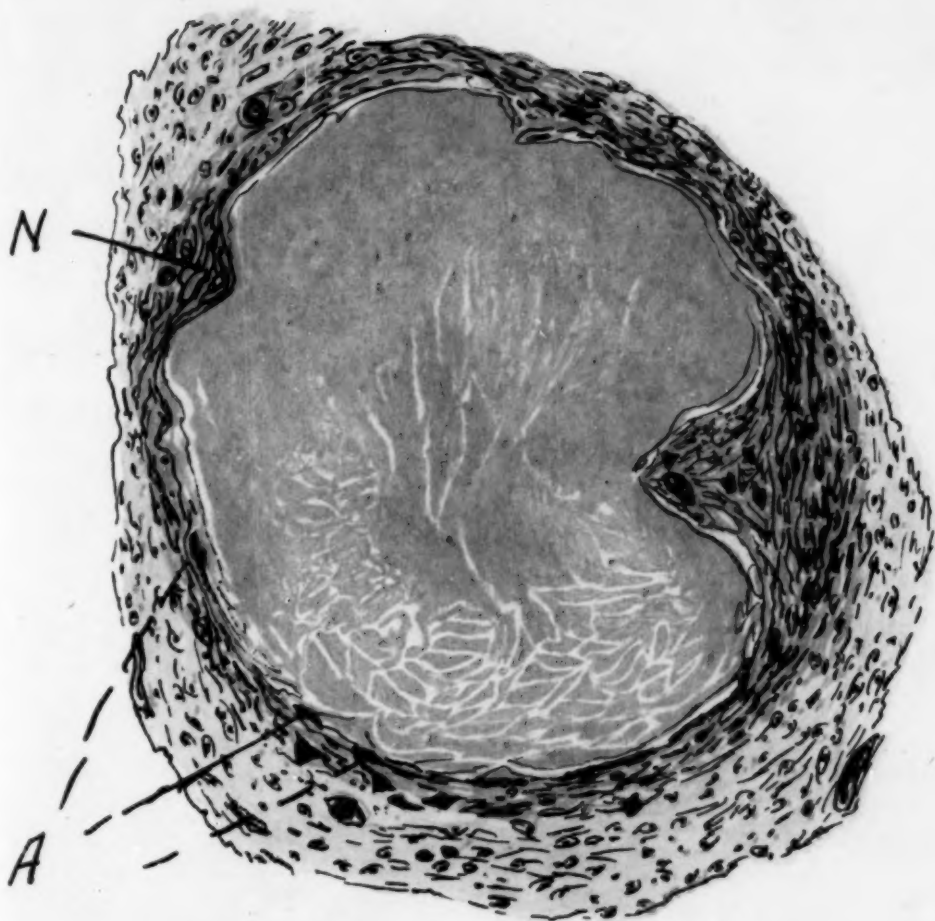
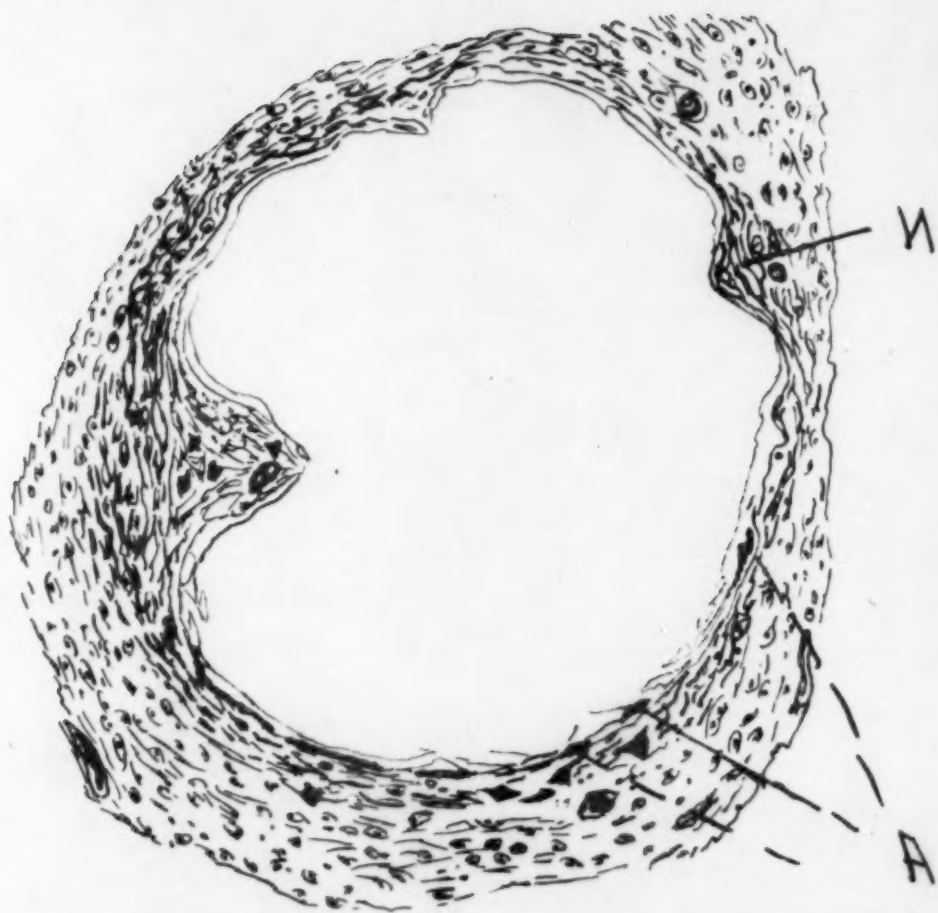


Fig. 7.—Hemorrhagic focus in left temporal region, showing fragments of connective tissue at A, the remains of a stretched and ruptured vessel wall scattered along the periphery on one side of the lesion. N, neuroglia, which have formed an artificial wall about the lesion which would make it appear on dissection like a true aneurysm. Pick found these false aneurysms in his cases. Mallory's anilin blue connective tissue stain: $\times 45$.



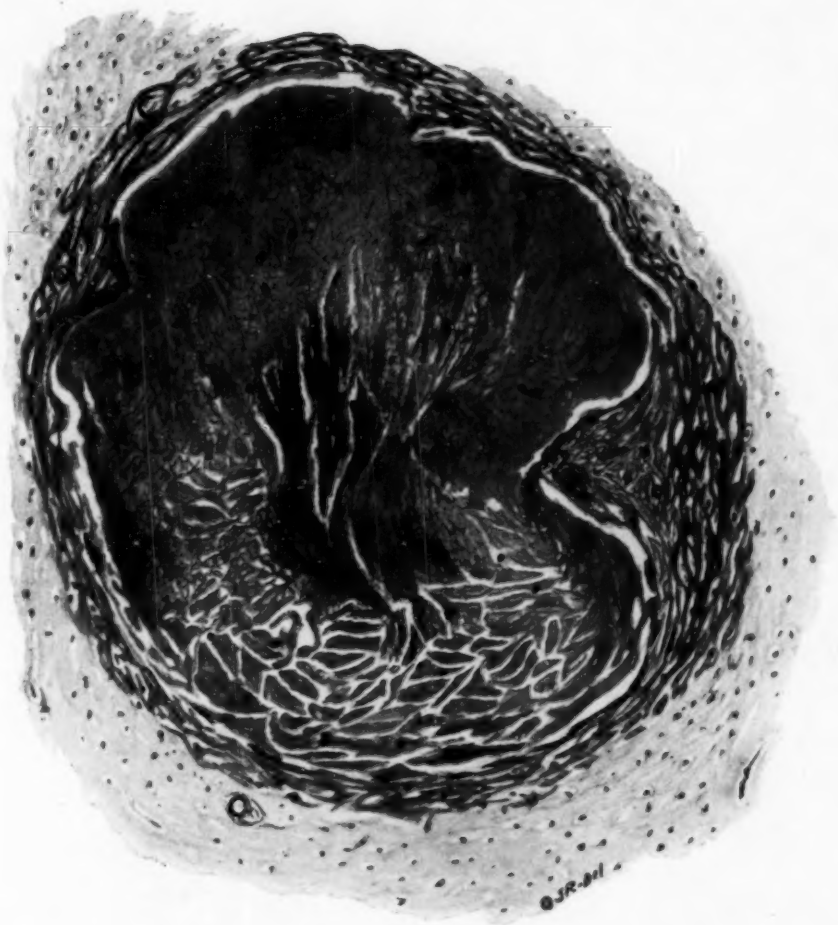


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took the form of dissecting aneurysms surrounded by a dense layer of gliosis (Fig. 5).

No evidence of syphilis or lead intoxication, such as lymphocytosis or plasma cell infiltration, was found. A rod cell was occasionally seen. Active gliosis and fibrillar glial replacement of destroyed areas were general. Rarely, a small vessel showed infiltration with leukocytes, both polymorphonuclear and lymphocytic.

DISCUSSION

The clinical course of this case, with repeated convulsive attacks and confusion and other psychic manifestations, sometimes with aphasia, or amnesia or even paralysis, but always with rapid recovery, and a high blood pressure throughout, seemed to be fairly well correlated with the anatomic findings. The cause of the underlying vascular lesion was undetermined. So advanced a degree of arteritis in a man 57 years old is unusual. Alcohol, syphilis and lead are the first factors to be considered. The patient had used alcohol moderately; the Wassermann tests were negative; the patient had been a steamfitter, but had showed no sign of lead intoxication. There may have been a diathetic factor, though in the face of an occupation of a laborious and possibly toxic nature during a period of years, predisposition as a cause may have become a minor factor.

The histology of the brain showed evidence of advanced and long standing arteriosclerosis and hemorrhages of different age and degree. The small cysts and gliotic foci were indicative of old hemorrhages. According to the clinical history, the patient seemed to have suffered from such ruptures at various times in the last three years of life. Necropsy examination showed that there had been numerous small hemorrhages but despite the high blood pressure, no single large extravasation occurred. It seems that the advanced sclerosis and inelasticity of the finer ramifications of the vascular system might have been a protection against extensive hemorrhage from rupture of a small vessel or miliary aneurysm, since the force of the high pressure found in the large arterial trunks would have spent itself in overcoming the resistance of the stiffened finer tubules through which it was forced to pass. Therefore only a thinned out or diseased wall such as would obtain in a dissecting aneurysm, would predispose to rupture. In this case foci of various degrees of atherosclerosis were found. The condition of the finer arterioles varied greatly. When the disease had progressed to a certain stage in several foci in which the strength of the wall was reduced to a degree incompatible with the blood pressure conditions, an acute strain or unusual effort caused a shower of small hemorrhages. Figure 7 indicates the apparent steps of the process by

which these small hemorrhages occur. By a close examination of this lesions, both by the Van Giesen and Mallory-anilin-blue methods, one could distinguish fragments of connective tissue, i. e., of the degenerated wall stretched around the circumference of the lesion. These fragments, however, were found only in one part—practically confined to one half of the periphery. The vessel was probably stretched by aneurysmal dilatation, the walls, especially the muscular coat, was degenerated, the elastica was torn and finally, the wall was ruptured at the weakest point. The wide separation of the torn sides accounted for the absence of any fragments of vessel wall along that part of the periphery. It was possible for these small hemorrhages to occur slowly and to be arrested by the clotting of the escaped blood, though the positive clinical evidence pointed rather to sudden hemorrhaxis. During the final illness, in which minute hemorrhages occurred, death did not ensue until extensive pulmonary disease had developed.

CONCLUSIONS

1. In a case of marked arteriosclerosis with repeated convulsive attacks, evidence was found, especially in the cortex, of numerous minute hemorrhages of various age and size.
2. Miliary aneurysms, chiefly of the dissecting type, were found in large numbers—hundreds in the hemorrhagic foci. They were rare in the interfocal spaces. The various vessel coats could not all be followed over the aneurysms.
3. The vascular lesion was an arteritis, with degeneration of the fenestrated membrane and the muscularis, and frequently a degeneration of these coats resulted in a single layer of hyalin substance.
4. Repeated showers of small hemorrhages during a period of almost three years failed to cause death.

THE INTELLECTUAL STATUS OF PATIENTS WITH PARANOID DEMENTIA PRAECOX

ITS RELATION TO THE ORGANIC BRAIN CHANGES *

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NAPA, CALIF.

The present investigation is an effort to obtain the intellectual status of apparently well preserved cases of paranoid dementia praecox. Gregor and Hänsel¹ hold that there is little impairment of memory until the terminal stages of the disease. Kraepelin² also considers that there is comparatively little involvement of memory until profound dementia sets in. In addition the latter finds that retention is often quite well preserved, while Gregor finds the power of retention considerably affected. It is in the field of memory and the higher associative processes that the present work is chiefly concerned, for it is felt that on the basis of the organic findings obtained by the author³ in her series of selected cases of dementia praecox an intellectual disintegration occurs much earlier than is generally conceded.

While the higher psychic processes are dependent on a preservation of memory, the ability to retain and recall perceptions which have been impressed on the brain cells at the height of their vigor and yet at the same time the inability to transform perceptions to general ideas and coordinate them into a logical whole shows a faulty psychic elaboration, a loosening of the unity and consistency of the psychic life, the basis of which may lie in the gradual disorganization of the connecting mechanisms of the various higher psychic centers.

Moreover, while volition and emotion influence the course of the psychic development, it is also true that they in turn are dependent on the intellectual activities, and a morbid process in the domain of the latter necessarily produces an emotional and volitional dulling with a resultant lack of intrapsychic coordination, a stoppage of further development and an ultimate disintegration in all fields of the mind as the disease process progresses, giving the characteristic picture of indifference to environmental influences with a psychology of everyday life which approaches those of races anthropologically lower.

That memory, the power of retention, logical association and constructive processes are as seriously affected as are the emotions and the will, seems evident from the results obtained. By memory is meant that form of independent psychic activity rather than the

1. Gregor and Hänsel: *Monatschr. f. Psychiatrie*, xxiii, 1.

2. Kraepelin, E.: *Psychiatrie*, Achte Auflage.

3. Rawlings, E.: *Histopathologic Findings in Dementia Praecox*, Am. J. Insan., 1920.

mechanical memory which is shown in an acquired proficiency due to a long and continuous association of ideas and habits, which on close analysis approaches more nearly a reflex type of activity.

TABLE 1.—HISTORY OF PATIENTS TESTED

Case	Age	Schooling	Occupation	Duration of Psychosis in Years	Delusions	Hallucinations	Orientation	Use of Alcohol	Wassermann Reaction
2319	55	High school	Telegraph operator	14	+	+	+	Moderate	—
3456	35	11th grade, grammar school, business college	Bookkeeper	10	+	+	+	—	—
5025	38	High school	Structural engineer	5	+	+	+	Occasional	—
11358	33	High school graduate, college	Student	13	+	+	+	—	++
15226	27	8th grade, grammar school, business college	Laborer	10	+	+	+	—	—
4014	64	Grammar school	None	44	±	±	+	—	—
10037	38	High school, business college	Bookkeeper	16	+	+	+	—	—
10425	34	High school graduate, law graduate	Admitted to bar	13	+	+	±	—	—
11710	49	University of Michigan, classical	Various	12	+	+	±	—	—
11830	43	9th grade, grammar school	School teacher	15	+	+	+	—	—
12249	36	8th grade, grammar school	Machinist	10	+	+	+	—	—
12903	36	High school graduate, law graduate	Failed to be admitted to bar	13	+	+	+	—	—
13542	52	8th grade, grammar school	Wood carver	24	+	+	+	—	—
14330	31	11th grade, grammar school	Machinist apprentice	12	+	+	+	—	—
15830	33	High school 2d year	Farmer	12	+	+	+	—	—
15903	42	High school graduate, college	Grover	15	+	+	+	—	—

The cases studied were carefully selected from among patients of native birth who had completed the grammar grade or received a higher education, and showed a fair or apparently normal intellectual preservation. An effort was made to select originally normal persons who had shown ability to utilize their scholastic opportunities, for it is well recognized that there are great individual differences in the original mental endowment which affect profoundly the capacity to profit from early training. Over fifty patients were tested, but on account of occasional delusional answers or evidences of inaccessibility or negativism, which made total scoring impossible, the list was narrowed down to sixteen. These cooperated in such a manner in all of the given tests that delusional trends and emotional and volitional aberrations had practically little or no influence on the thought processes. The patients were tested with the revised Yerkes-Bridges⁴ point scale

4. Yerkes, R. M.; Bridges, J. W., and Hardwick, R. S.: A Point Scale for Measuring Mental Ability, Baltimore, Warwick & York, 1915.

in order to obtain the general level of intelligence. A series of other tests were given for the higher and more complex phases of mental activity, such as the power of comprehension, thought direction, abstraction, the ability to establish connections between concurrent and successive psychologic activities, the capacity for response, etc., in order to obtain the intellectual deficiency, if any existed, along the lines in which they had been especially equipped.

Table 1 gives a summary of the important historical findings which may have a bearing on the present intellectual status of the patients.

INTELLIGENCE TESTS

Point Scale Tests.—In the point scale tests Professor Yerkes' revised graphs of 1917 were used in obtaining the norms. As all of the tests were made on men, the graph for males was used rather than the combined one. The results obtained showed a general average score of 72 points with a mental age of 10.9 years and an intellectual quotient of 68. Yerkes' twenty-five male mill operatives, with whom the patients may reasonably be compared, made a general average of 88.3 points; using the revised graph with its limits of 90 points and 16 years, they gave an average mental age of 14 years. In the tests, the subjects showed comparatively little of the scattering obtained in psychotic cases.

The analysis of the results shows that this series obtained a general average of 100 per cent. in the first three tests, 82 per cent. in the fourth or the memory test for digits, 100 per cent. in the fifth test, 46 per cent. in the sixth or the memory test for repeated sentences, rising again to 86 per cent. in the seventh test and then showing a rather progressive lowering in percentages obtained as the tests became approximately more difficult. It is interesting to note that they made such low averages in the memory tests, for they were apparently devoting their attention to the subject in hand and cooperating well in other respects. The results of the tests seem to demonstrate little involvement of the simple perceptual processes, sensory discrimination and esthetic judgment but considerable impairment of the processes of comparison, abstraction and generalization, a loss in the critical faculty and apperceptive activity. With one exception, the patients gave definite evidence of considerable intellectual deterioration. The results are shown in Table 2.

Kent-Rosanoff Test.—In the Kent-Rosanoff⁵ test for uncontrolled association the patients responded by a single term to each of a series of words. In this test they were found to be slower than normal and

5. Kent, Grace, and Rosanoff, A. J.: A Study of Association in Insanity, *Am. J. Insan.* 67:37, 390, 1910.

showed partial dissociations and preservations due to a moderate immobility of attention and an inability to dismiss from their minds previous stimulus words. Cases 10037 and 12993 showed a repetition of the stimulus words with multiverbal, nonspecific and predicative responses, the last type being especially numerous as their association times were unusually slow. The subjects seemed to grope for a response word more from a dearth or paucity of ideas than from the presence of emotional complexes. As a rule, their responses displayed more interest in the individual and concrete than in the more general and abstract, there seeming to be little interest in the far reaching relations existing between things. Their range of surface ideas was rather narrowed, and they were decidedly personal and subjective. The results of this test compared with the norms obtained in 1,000 adult cases by Kent and Rosanoff showed that these patients gave markedly fewer common associations, higher doubtful associations and strikingly increased individual associations, the last probably influenced by their delusional content. The test shows that they more nearly approached the norms for children under 11 years of age. It will be observed that the curve of performance in this test is somewhat parallel with that of the association test (No. 13) of the point scale, but it is more valuable in that it accentuates the deviation from the normal. The results are shown in Table 3.

TABLE 3.—RESULTS OF KENT-ROSANOFF UNCONTROLLED ASSOCIATION TEST

Case	Common	Doubtful	Individual	Failures
2310	60.5	7.8	25.2	6.5
3456	60.2	2.5	24.5	3.8
5025	70.6	3.4	24.5	1.5
11358	72.3	5.8	20.6	1.3
15226	60.5	3.5	30.2	5.8
4014	30.6	18.7	35.3	15.4
10087	28.2	15.5	38.0	18.3
10425	38.2	12.5	32.7	16.6
11710	62.3	4.6	27.1	6.0
11830	64.2	5.2	25.0	5.6
12249	60.0	2.8	29.2	8.0
12998	65.6	3.0	27.2	4.2
13542	72.3	8.0	15.4	4.3
14330	65.1	7.2	24.8	2.9
15630	75.5	3.5	21.0	0.0
15908	65.3	8.9	25.8	0.0
Averages	60.0	7.1	26.6	6.3
Kent-Rosanoff norms	91.7	1.5	6.8	0.0

Controlled Association Tests.—The controlled association tests, designed to discover the ability of the subject to appreciate logical relations and his power of adjustment to react according to instructions, were limited to the part-whole, the genius-species, the opposites tests and computations. In the part-whole tests the list of twenty words

recommended by Pyle⁶ was used, for the genius-species test the Woodworth and Wells⁷ twenty test words were used, and in the opposites test Pyle's twenty easy and hard opposites were used. The responses expected to the stimulus words in these tests were restricted to a single form of relationship throughout the series.

In computation, problems were given in addition, subtraction, multiplication and division. The recording of results was done at times by the patient, at others by the examiner, in order that it might be determined whether the process of recording disturbed his associations. The quality of the work was estimated as proportional to the percentage of correct solutions. Speed was not considered as valuable an index as the patient's mental environment during his hospital residence was less stimulating as to rapidity of mental processes than the environment of the normal person, and he was necessarily slower in time reactions. Moreover, individual differences in fatigability of the patients were so modified by the disease process that work curves could not be obtained which were of value as an index of original habit and method. The quantity of work was also modified by the same factors, the amount produced being much below the norms given for adults by various investigators. No attempt was made to correlate efficiency in the various forms of computation as the abilities demanded were too dependent on the original capacity of the patient to be estimated with any degree of accuracy.

The results obtained in these tests showed quite clearly that the patients were defective in their ability to reason, in their efforts to appreciate relationship and to control their associations. They fell within the range of children from 8 to 13 years of age, with one exception. The exceptional case patient, case 15903, ranged between 13 and 14 years, though he was shown to be normal by the Yerkes-Bridges tests. The total averages were: part-whole 8.3, genius-species 7.2, opposites 10.5. All of these were far below the norms for adults, according to Pyle, the part-whole average being 18.5, species-genius 15.1 and opposites 22.1. The general averages of these patients were those of Pyle's 11-year old children. In computations they made a general average of 64.8 per cent. of correct answers. Their responses were quite uniformly uninfluenced by their delusions, and they rarely failed to give an answer, cooperating readily and frequently with a child-like eagerness to do well. Their time of responses in the first three tests were so much longer than in the norms obtained by Woodworth and Wells and Pyle, and showed such variations that it was

6. Pyle, W. H.: *The Examination of Schoolchildren*, New York, 1913.

7. Woodworth, R. S., and Wells, F. L.: *Association Tests*, Psychol. Monog. 13: 1910-1911.

decided to score solely in terms of number of correct associates without reference to time limit, as speed was considered of less importance than qualitative differences. The results are shown in Table 4.

TABLE 4.—THE CONTROLLED ASSOCIATION TEST

Case	Part-Whole Test	Genius-Species Test	Opposites Test	Computations of Correct Answers, Percentage
2810	8.5	7.8	11.0	55
3456	6.0	5.6	8.1	65
5025	7.8	7.2	10.6	70
11356	8.0	7.4	10.9	90
15226	6.3	6.0	8.6	38
4014	8.2	7.1	10.8	66
10087	6.1	5.1	8.0	50
10423	7.8	6.8	9.9	75
11710	8.9	7.9	11.2	88
11690	11.2	8.3	12.5	90
12249	7.1	6.1	9.0	48
12968	8.2	6.0	8.3	45
13542	8.5	7.5	11.0	69
14330	8.2	7.8	12.1	49
15890	8.9	7.5	11.2	72
15908	13.8	12.2	14.7	98
Averages	8.3	7.2	10.5	64.6
Pyle's norms	18.5	15.1	22.1	

TESTS OF IMAGINATION AND INVENTION

These tests were given to gage the patient's ability to think in images in the narrowest meaning of the term; that is, the presentation of their past experiences in such a new form that they did not refer definitely to any part of the same experiences. Every effort was made to break up the dreaming habits which many of the patients had formed and to direct their thought toward a purposeful effort to dissociate old combinations of past experiences and to combine them into active, creative productions. The individual differences in their mental traits in regard to wealth or paucity of spontaneous imagery in phantasy, and their capacity for creative thinking and ability to organize and plan, were shown to vary widely and to be quite generally less elastic and productive than would normally be expected of the average adult of common school education. While in a few instances their productions were colored by their delusional content, their train of thought could be sufficiently controlled to make the tests of value in judging their sense perceptions, their ability to form new associations and their fertility of imagination. As a rule, their qualitative classifications were decidedly commonplace, scientific and literary reminiscences being quite generally absent, even in those who had received more than a high school education. They showed their lack of fertility by frequently confining themselves to single types of imagery, which were nonconstructive in character. In order to allow their associations freer scope,

their responses were not written and their speed of associations was not estimated as it was found that they grew discouraged, their efforts at rapid associations seeming to retard their thought processes, limiting these frequently to objects within visual range.

Four tests were given: the ink blot test,⁸ the Masselon test,⁹ the development theme test⁸ and Ebbinghaus' completion test.¹⁰

The Ink Blot Test.—This test was used to find out the fertility of their visual imagination, the score being based on the total number of associations and the type and variety of the imagery, with no time limit. In this test four patients gave 8 associations, five gave 6, three gave 5, three gave 2 and one saw nothing in the ink spot, the average being 5.2 for associations. The type and variety of responses given were largely confined to the ordinary objects of their everyday life in the institution, few seeming to reach beyond it and then only along their delusional trends. The results of the test were a striking commentary on the nonconstructive ability of the patients as a whole, when it is considered that Pyle's adult males averaged 10.6 for associations with a time limit of three minutes.

Masselon's Test.—This test was elaborated into the invention story containing a number of prescribed words, the words being both nouns and verbs. Latitude was allowed in the use of singular or plural forms, possessive, nominative or objective cases in the nouns and any forms of the given verbs. In this test the responses were scored quantitatively as to number of sentences given and qualitatively as to whether the arrangement of the words was largely mechanical or whether they gave a concrete situation, and if given a concrete situation, whether it was dealt with in a limited or a fully outlined manner. The results in this test showed a correlation with the ink-blot test; the patients who manifested the greatest ability in the latter also showed the most constructive capacity in their development of sentences. They further showed that the sentences were largely mechanical in character, there being an awkwardness and inelasticity which suggested trains of thought that ran in ruts and which were switched along other lines to a great extent by delusional pressure.

Development Theme Test.—In this test the subjects chosen were mainly related to the patients' specific interests before the onset of their psychoses. As a rule, they were expository in type rather than imaginative, as it was felt that the imaginative type would give freer

8. Sharp, Stella E.: Individual Psychology, Am. J. Physiol., 1899.

9. Masselon, Psychologie des Déments précoces, 1904.

10. Ebbinghaus, H.: Ueber eine neue Methode zur Prüfung geistiger Fähigkeiten in ihrer Anwendung bei Schulkindern, Ztschr. f. Psychol. u. Physiol. d. Sinnesorg. 13:401, 1897.

rein to the delusional trend and thus defeat the object in view. In this test the patients were given a time limit of fifteen minutes. Their productions were scored as to quality on a basis of the relative number of ideas elaborated and the judgment shown in the ideas expressed. The results of the test in the majority of cases were rather disappointing. With a few exceptions, there was a lack of constructive ability, and the ideas expressed were limited as a rule to commonplaces. Moreover, a generally low mental type was displayed, due to the absence of native retentiveness and capacity to recall.

Whipple¹¹ states that the relative number of ideas elaborated by the subject was indicated with fair approximation by the relative number of words written, so that the number of words may stand as a fair index of fluency of ideation and general linguistic readiness. Sharp's⁸ test subjects, in her study of university students, wrote an average of 259 words on imaginative and 222 on expository themes in ten minutes; her poorest subjects wrote an average of 124 and 94 words, respectively, for the same types of themes. The number of words produced by our group of patients ranged from 9 to 110, the average being 64 words. It is possible, to a certain extent, to compare their work with Sharp's poorest subjects, the averages of the latter being higher than in our series.

Results of Test: Several of the patients whose intellectual equipment best fitted them for this test responded thus: The patient in Case 5025, with the theme "Bridging the Niagara," produced a short sentence exposition as follows: "It can't be done. Yes, it could. I'd construct piers, eight of them and span it with cement. Sink the piers deep enough into the river bed. Might have the piers hollow, as probably stronger. Easy to do. Make them of steel. Then build a cement floor from pier to pier." Case 11358.—Theme: "The Death of Lincoln." "Lincoln was president. Seward was the secretary of state. The president and all the members of his cabinet were in the theater Ford in Washington. Booth did it." Case 10425.—Theme: "The Delays of Justice." "There are lots of delays in justice, due to one thing and another. Can't do anything about it. Just have to wait as trouble is often with the politicians. Sometimes you have to hunt up evidence to prove you have to hang a man or put him in jail and that takes time. Takes money to do things. Lot of delays in law." Case 11710.—Theme: "Who Influenced the World to a Greater Extent, Rome or Greece?" "The Spartans, they were from Sparta and the Athenians, they were from Athens and were as refined and cultured as could be. I suppose the Grecians influenced the most and still I don't know. I suppose the Romans. I guess the Grecians, but in world power I guess the Romans in war powers was a tremendous influence on the world in keeping the war pot boiling for years." Case 12993.—Theme: "Leniency of the Law Toward the Soldier." "Soldier fights. If he kills is supposed to kill." This was all that was obtained, although it was carefully explained to the patient that the leniency was in regard to general minor misdemeanors and not connected with

11. Whipple, G. M.: *Manual of Mental and Physical Tests, Part II, Complex Processes*. 1915.

the direct business of war, that of killing. Case 15903.—Theme: "Have Events Proven That the Sacrifices of the Civil War Justified the Freeing of the Negroes?" "Yes, for the reason that human liberty must be preserved and because slavery was degrading to both white men and black. The South is going to be more prosperous and more active because of better morals and competition. These things are providential, they are beyond our understanding sometimes." Case 2319.—Theme: "Death of a Dog." "A dog running after a wheeled cart was run down by an automobile. It is the duty of people to care for their dogs, especially when injured. The dog was badly injured and died immediately after and there was therefore nothing to do for him. He could have been taken to a hospital, a sort of dog hospital but as he was dead there was no use." Case 11830.—Theme: "The Influence of Newspapers." "The power of the press for forming public opinion can hardly be overestimated. Politics, daily tho't, our idea of the country at large all are shaped more or less by what we read on these subjects in the daily or weekly papers. Where yellow journalism does not overrule the factor of the newspaper is mainly for good. The births and deaths of our friends, is recorded there. The price of our commodities; the goings and comings of those we know. It ranks with the railroad and schools as a harbinger of civilization and educator of the masses. We could as well do without the church as without the newspapers."

Completion of the Test of Ebbinghaus.—Terman's eagle story, as given by Whipple, was used, entire words being elided. The patients were allowed to read the test and then fill in the elided spaces. They were given fifteen minutes and one trial only. Quality of work, not time, was considered. The results were computed on the basis of one credit for each elision filled in in any manner, 0.5 debit for each unfilled elision and one debit for each elision which did not make sense or for each word introduced in excess of the number called for; the second and third were subtracted from the first, and the percentage computed. As the test was considered by Ebbinghaus as especially valuable in gaging the intellectual activities that are fundamentally important and significant both in the school and in life, and as numerous other investigators have agreed in the main with him that it was a reliable test of intellectual ability, the results to be obtained with these patients were looked forward to with interest. Its performance required considerable diplomacy to obtain the cooperation of the patients as the elisions had a tendency to arouse delusional trends, in fact, for this reason a number of the patients were dropped from the list to be reported. The results obtained ranged between 20 and 65.8 per cent., the general average being 45 per cent. There was a rather marked reduction in each case, except in Case 15903, in percentage from the normal percentage to be expected from the original intellectual equipment of the patients, the results correlating with the rates obtained by the other tests. The lack of creative ability on the part of the patients as shown in their low general average, indicated fairly well the degree of intellectual deterioration which had taken place.

GENERAL AND SPECIFIC INFORMATION

Questions were asked in geography, history and arithmetic in order to establish a memory defect, if one existed. These questions were obtained by giving a number of general questions on these subjects to ten normal adults between the ages of 30 and 40, with an education not beyond the twelfth grade. From the questions answered correctly were selected five in geography, five in history and ten in arithmetic. The patients were also asked a number of questions on subjects studied in their college courses, care being taken to make them sufficiently simple to allow for the normal dulling of memory due to the lapse of time and the disuse of the knowledge acquired. The results showed that in only one case of the entire series of sixteen patients was the memory capacity for reproducing general and specific information at all equal to that of the normal person of like age or educational training. In all others the memory was seriously impaired.

SUMMARY AND CONCLUSIONS

The sixteen selected cases of paranoid dementia praecox scored by the Yerkes-Bridges point scale a general average of 76.5 points with a mental age of 11.6 and an intellectual quotient of 72. Various tests for uncontrolled and controlled association and for imagination and invention correlated rather well with the point scale scores, giving the patients a general average of 11 to 12 years. Tests for their general and specific knowledge demonstrated a diminution in linguistic fluency, patchy memories, ideation frequently commonplace and sterile in type, tendencies to deal with the concrete rather than the abstract when the latter was indicated, and a general crudeness and lack of flexibility in the use of their available mental equipment.

Correlating the clinical with the pathologic findings obtained, I found an impairment of the faculties of the mind, involving not only volition and emotion, but also the higher intellectual faculties of memory and the power of reasoning and the acquired capabilities. The disease process as a rule began insidiously with a progressive lowering of the intellectual levels, producing a gradual loosening of the train of thought with a resultant incoherence and disconnection, a deterioration in judgment, as shown in the patient's inability to order his life consistently from an environmental standpoint and the presence of more or less automatic or reflex activities which took the place of conscious purposeful action based on an intact psychic mechanism. Anatomically the destructive processes, while exerting their maximum effect on the frontal and central regions, diffusely attacked the cortex, most seriously affecting the more superficial nerve cell layers. These, so far as we are able to determine, are concerned with the phenomena

of memory and its associative mechanisms, the processes of abstraction which form the psychic personality, and the associating activity which takes place with the deeper cortical layers involved in volitional impulses and sensory perception.

Ariëns Kappers,¹² in his comparative work on the cortex, drew the conclusions that the neocortex, as distinct from the superficial layer of fibers, must consist of two functionally different zones: an outer supragranular stratum which was associative, receptive and sensitive in function and an inner and infragranular stratum which was corticofugal and commissural; between these two zones, in the granulated cortical regions, lies the granular cell layer, lamina granularis interna, whose short fibers he considers as intrahemispherical and short associative in character. He includes this lamina granularis interna with the two external receptive strata, making them all receptive and associative, the only difference being that the granular stratum establishes intracortical connections at short distances and the stratum above it at much longer distances.

E. G. Van't Hoog,¹³ in his study of the cortical strata and their functions, ventured the following conclusions: The cells of the lamina granularis interna should be considered as matrix cells which may become differentiated into the more highly differentiated supragranular pyramids and that animals whose neocortex is without this granular layer, or so sparsely supplied with it that they may be considered to be without it, belong to a class that has reached a blind alley in its development; the reserve cells are entirely expotentialized.

In the brains of my patients with dementia praecox I noted in the conclusions that there was a "singular fragmentation of the stellate nerve cell stratum in all the cases." It is this stratum that corresponds to Kapper's lamina granularis interna. In no other psychosis have I observed such a marked destruction of the nerve cells of the stellate layer of the brain, except possibly in the extremely atrophic senile cortex. Kappers' idea of the short associative character of this layer and Van't Hoog's premisis that it may be considered a matrix cell layer capable of differentiation into the cells of the upper strata throw a possible light on the peculiar rapid mental bankruptcy which occurs in the praecox psychosis. In view of Van't Hoog's conclusions, may we not be dealing in dementia praecox, with an embryonic condition in which the granular space is less than normal or of such lowered

12. Kappers, Ariën: The Phylogenesis of the Palaeocortex and Archicortex, Compared with the Evolution of the Visual Neo-Cortex, Arch. of Neurol. & Psychiat., 1909.

13. Van't Hoog, E. G.: On Deep Localization in the Cerebral Cortex, Trans. by Sylvia Jelliffe, J. Nerv. & Ment. Dis. 51:313 (April) 1920.

potentiality that the cells are incapable of differentiating into a normal type, or into a normal type beyond a certain period of life when they become exhausted under the stress of environment, or a possible toxemia due to a maladjustment of bodily functions? In the gradual destruction or exhaustion of this cell layer, we have the beginning break in the connecting fibers with the lower corticofugal cells with a disturbance of the sensorimotor reflexes producing the emotional and volitional aberrations observed in the disease. Moreover, as these cells become exhausted, we have a lack of the potential factors which make up the supragranular stratum, resulting in a beginning decline in the psychic life, a decline further hastened by a continuance of the disordered metabolism with its toxins diffusely attacking the nerve cells of the upper cortical layers, which are made more liable to destructive influences by the cutting off of their reflex sensory stimulation.

CEREBELLAR FITS

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This paper is based on the seizures that occurred in a series of forty-five cases of subtentorial brain tumor, in which the patients were operated on at the Neurological Institute during the past few years. Twenty-three were cases of cerebellar tumor, six were cases of tumor of the pons and midbrain, and sixteen were cases of the cerebello-pontile angle.

EXPERIMENTATION AND CEREBELLAR EXCITABILITY

Since the well-known experiments of Flourens with pigeons nearly a century ago, it has frequently been demonstrated that ablation of parts of the cerebellum may be followed by peculiar forced movements of the limbs and body. A dog with half of the cerebellum removed may circle about toward the side of the lesion. Monkeys with the inferior cerebellar peduncles divided, thrust their body and limbs about in an odd manner and assume various rigid and sustained attitudes.

The electrical excitability of the cerebellum is a matter for further investigation. Since the first experiments of Ferrier¹ many important studies have been made, notably by Pruss, Versiloff, Negro and Rosendo, Clark and Horsley,² Rothmann, Uffenorde and others. Some of the findings are uniform but many are contradictory. For instance, some observers (Pruss,³ Versiloff³) have obtained by electrical stimulation of the cerebellar cortex, certain motor responses of the neck, trunk and extremities, which in their general character resemble those obtained by stimulation of the cerebrum in that the contractions of isolated muscle groups were both tonic and clonic. Clark and Horsley, remarking that strong stimuli are required to evoke a decisive effect from the cortex of the cerebellum, as all experimenters have agreed, questioned whether in positive cases the results obtained might not be due to diffusion of the stimuli to underlying nuclei. Later these

1. Ferrier: Allbutt's System of Medicine 7:376, 1901.

2. Clark and Horsley: Brain 31:121, 1908.

3. Pruss, Versiloff, quoted by Tilney: Neurol. Bull. 2:303 (Aug.), 1909.

observers,² using a perfected technic with the bipolar method, concluded that the cerebellar cortex is not excitable.

As the problem of cerebellar excitability is still the subject of dispute, it seems to us impossible to derive therefrom any satisfactory conjectures as to the mechanism of cerebellar fits or the frequency with which they might be expected in lesions of the cerebellum, such as result from the growth of a tumor.

THE CEREBELLUM AND MOTILITY

André-Thomas⁴ calls attention to certain clinical and experimental observations which are of especial interest to the subject of this paper.

According to the observations of Horsley, the activity of the nerve centers is "translated" by a combination of clonus and tonus factors, and the resultant motor manifestations differ according to the proportions of one or the other of these factors. Clonicity is a property of the cerebral cortex and tonicity of the lower centers. The conclusions of Horsley and Bouché on this point were demonstrated experimentally. They injected essence of absinthe into the jugular vein of a cat three weeks after ablation of its left cerebral hemisphere. On the right side of the body, represented cortically in the ablated hemisphere, an attack of tonic contractions occurred,⁵ with the limbs in extension. On the left side, represented in the intact right cerebral hemisphere, a tonic-clonic attack of contractions was produced, with the limbs in flexion. During the course of an attack, the authors made an instantaneous section through the midbrain: immediately the clonic movements were changed into tonic movements of the whole body, the head was drawn backward and the limbs of the formerly flexed left side went into extension. Excitations of the inferior centers, among which is counted the cerebellum, gave rise to exclusively tonic attacks.

Some clinical facts sustain these observations. Hughlings Jackson⁵ cited the case of a child afflicted with a tumor of the median lobe of the cerebellum, in which tetanoid convulsive attacks were observed. The forearms were flexed on the arms, the arms were held close to the sides, the head drawn backward, the body was in a position of opisthotonos with extended legs. Jackson concluded from this: 1. In convulsions of cerebellar origin the spasm is tonic, whereas in cerebral convulsions it is principally clonic. 2. Cerebellar convulsions affect more the bilateral muscles of the legs and trunk, whereas in cerebral affections one side is more involved than the other and the arm more than the leg. 3. Cerebellar crises resemble tetanus more than epilepsy.

4. André-Thomas: *Cerebellar Functions*, New York, 1912, p. 167.

5. Jackson, Hughlings: *Med. Times & Hosp. Gaz.* 1:626, 1865.

This contrast between the clonic character of cerebral convulsions and the tonic character of cerebellar ones is to be compared, according to André-Thomas, with the special form that movement takes in persons with cerebellar atrophy. It becomes "discontinuous and clonic," apparently on account of the disappearance of the tonic cerebellar influence.

MAJOR CEREBELLAR SEIZURES

For the classic picture of what may be considered a major cerebellar seizure, we are indebted to the observations made years ago by Hughlings Jackson.⁶ He declared that attacks of tonic rigidity of muscles of the back of the neck, with retraction of the head, associated with flexion of the forearms and extension of the legs and pointing of the toes, were an especial feature of tumors of the middle lobe of the cerebellum and a direct result of cerebellar irritation.

Rigidity of the muscles of the neck and jaws, with rigid extension of the extremities and flexion of the arms, was noted by McCewen⁶ in cases of subtentorial abscess. Retraction of the head and rigidity of the masseters were reported in similar disease states by Drummond,⁷ Friedeberg⁸ and others long ago. While such symptoms are not unusual in inflammatory conditions in the posterior fossa, they have seldom been observed to occur with tumors of this region.

In Stewart and Holmes'⁹ series of forty cases of cerebellar tumor, there was one case, a large tumor of the under surface of the vermis, in which extensive hemorrhage occurred into the substance of the left cerebellar hemisphere during operation; whereupon, while the patient was still under the anesthetic, a rigid spasm of the whole body occurred which "was purely tonic in all the limbs and uniformly maintained for about three minutes." There was retraction of the head and opisthotonos. The face and respiration were undisturbed. Attacks similar to the first recurred frequently until death nine hours later.

Dana¹⁰ has described attacks that occurred in cases of tumor of the cerebellopontile angle, which consisted of loud tinnitus or a roaring sound, vertigo with a tendency to pitch or fall to the ground, sometimes sudden blindness or clouding of consciousness and, in severe attacks, tonic spasms of the extensors lasting from two to five minutes.

In our series, one case comes under the heading of major cerebellar seizures.

6. McCewen: *Pyogenic Diseases*, 1893, p. 197, Case 1.

7. Drummond: *Lancet* 2:190, 1894.

8. Friedeberg: *Berl. klin. Wchnschr.* Aug., 1895, p. 719.

9. Stewart and Holmes: *Symptomatology of Cerebellar Tumors; A Study of Forty Cases*, *Brain* 27:520, 1904.

10. Dana: *The Cerebellar Seizure (Cerebellar Fits), A Syndrome Characteristic of Cerebellar Tumors*, *New York M. J.* 81:270, 1905.

CASE 1.—A. P., a girl, 11 years old, at the age of 3 began to have attacks of nausea and vomiting. A short time later some gait disturbance became noticeable: she did not lift her feet clear of slight obstructions. Occasionally she complained of pain over the mastoid region. The interesting feature is the occasional occurrence, after the first year of her illness, of attacks of general rigidity with opisthotonos, both arms flexed and raised, lower limbs extended, toes pointed. These attacks were accompanied by vomiting and marked nystagmus. It is remarkable that only at these times was nystagmus observed.

At operation (Dr. Elsberg) a cystic tumor was found involving the middle and right lobes of the cerebellum.

ATTACKS OF TONIC SPASM AND FORCED MOVEMENT

Stewart and Holmes reported a few seizures in large tumors of the pons and cerebellum, which were unlike anything they had seen in forebrain lesions in that the spasms were attacks of purely tonic rigidity quite different from the typical tonic-clonic spasms which result from instability or irritation of the cerebral motor areas. They also described attacks of jerking of an irregular shock-like character, in the homolateral arm in a case of one sided cerebellar tumor. According to the statement of the patient, the contralateral arm was also occasionally simultaneously affected but always in slighter degree.

None of our cases presented an example of general forced movements of the trunk, and it is likely that the forced movements which result from experimental ablation have nothing but an incomplete counterpart when the cerebellum is injured by a lesion such as tumor. Dr. Dana said that in one of his cases, that of a woman with a tumor in the posterior fossa, who, as a comparatively early symptom, would, in what he regarded as a forced movement, extend her body suddenly and slide from her chair to the floor.

Among our forty-five cases, there were four which presented at some time or other, homolateral rigidity of an extremity with irregular spasmodic jerking movements.

CASE 2.—C., a girl, 15 years old, for six months had had increasingly severe attacks of headache, usually in the morning, occasionally accompanied by vomiting. The pain was most marked in the temporal regions, especially the right. During the past two or three months vision had been failing and during the past week dizzy spells had frequently occurred. Lately she had had occasional convulsive attacks of the left arm. The movements, unlike a jacksonian fit, were aimless, somewhat sudden stiff jerks, of an irregular or arrhythmic character, with no local point of commencement, no gradual spread to other parts and no clouding of consciousness. Operation (Dr. Elsberg) disclosed a tumor involving the left lobe of the cerebellum.

CASE 3.—L., a woman, 43 years of age, had noticed for ten years "a heavy tired feeling" in the right side of the tongue. For five years hearing in the right ear had been poor and she was troubled by a noise in the head "like

steam escaping from a radiator." At times she talked only with difficulty, as one intoxicated. For two years she had had peculiar attacks involving the right side, arm, and leg, which were quite unlike a jacksonian fit. The movements had no local point of commencement, no gradual spread, and were not rhythmic or clonic in character. The attack might be described as a sudden loss of control of the limbs on the right side, which trembled and were stiffly thrust about. A tumor of the right cerebellopontile angle was found at operation (Dr. Taylor).

CASE 4.—S. P., a woman, 31 years of age, for eighteen months had had increasing difficulty in walking, was ataxic and dizzy. For twelve months the muscles on the left side of the face had been weak. During the past month there had been severe attacks of headache with vomiting, mostly in the morning. During the past week the patient had been confined to bed.

Two attacks had occurred during the past week. The attacks were accompanied by intense headache and numbness of the left side of the face, and the patient was unable to speak although conscious. The movements had no local point of commencement, no gradual spread and were not clonic, but were sudden, jerky, spastic, of wide range, of irregular character, arrhythmic and confined to the left arm. At operation (Dr. Elsberg) a tumor was found in the left side of the cerebellum.

CASE 5.—M., a woman, 48 years of age, for years had had occasional severe general headaches. For the past few months she had had frequent occipital headaches and a more or less persistent pain in the back of the neck. For eight months her gait had become increasingly ataxic. She had marked tinnitus and dizzy attacks so severe as to cause her to fall. Her left leg had felt heavy at times during the past few weeks. Lately attacks involving the left arm had occurred which were not true convulsive movements but might be described as sudden seizures of ataxia or spastic unsteadiness. The fingers trembled and were unable to hold anything, and there was an associated unusual nodding or ataxic tremor of the head. There was no loss of consciousness. At operation (Dr. Elsberg) a tumor was found in the left cerebellopontile angle.

VARIOUS CRANIAL NERVE ATTACKS

Irritation of the cranial nerves about the pons and medulla by tumors in the posterior fossa, may cause striking symptoms of abrupt onset. Starr,¹¹ Sorgo¹² and others have described vagal attacks due to pressure on, or stretching of, the vagus nerve at the foramen magnum. Oppenheim¹³ has mentioned a case in which the patient had persistent contraction of the soft palate and vocal cords. Cushing¹⁴ speaks of "cerebellar crises" occurring in two of his thirty cases of cerebellopontile angle tumor. He describes them as paroxysms of extreme and agonizing type, with retraction of the neck and head, res-

11. Starr: *Am. J. Med. Sc.* **39**:552, 1910.

12. Sorgo: *Monatschr. f. Ohrenh.* **35**:285, 1901.

13. Oppenheim: *Text-book of Nervous Diseases*, Trans. by Bruce, Foulis, London, Ed. 5 **2**:907, 1911.

14. Cushing: *Tumors of the Nervus Acusticus*, Philadelphia, W. B. Saunders Company, p. 170, 1917.

piration difficulties, altered pulse, a sense of impending death and possibly unconsciousness. There are five other patients in his series who also had some "discomfort" of this kind, but in a much milder form.

Two of our patients had speech and swallowing difficulties, and one of them had also periodic choking sensations with respiratory embarrassment, but there were no patients in our series with severe "cerebellar crises," such as Cushing describes.

CASE 6.—K., a woman, 27 years of age, for four years had been troubled by a roaring sound in the right ear, which she compared to the sound of falling water. Since it began she had been almost deaf in this ear. Fifteen months before, while pregnant, dimness of vision had commenced; headaches with attacks of vomiting commenced about the same time. These symptoms persisted after the baby was born, and then in addition there came times when she would see double. During the past few months the patient had staggered toward the right. Her eyesight had continued to fail rapidly, and for the past few weeks she had been quite blind in the left eye and nearly so in the right. Lately she had had spells in which it was difficult for her to speak and sometimes difficult to swallow, accompanied by a panicky feeling as though she were about to choke. At operation (Dr. Elsberg) a glioma was found involving the right cerebellar lobe.

CASE 7.—Kr., a woman, 47 years of age, for two and a half years had had constant discomfort in the left eye: "It feels as though an eyelash were in it." At about the time that this came on, she also began to have a queer sensation in the left side of her face, "like a bug crawling." Until six weeks before there had been no headache, but since that time she had had considerable pain in the occiput and back of the neck. For one month she had been dizzy and ataxic, staggering toward the left. Her tongue had felt numb, there had been a constant sweet taste in her mouth and a discomfort in her throat which caused her to swallow constantly in an effort to get rid of it. There was an occasional roaring or whistling sound in her ears, especially in the left. Lately she had had difficulty in speaking and in swallowing, and a convulsive tic had commenced in the left side of her face, which in the past few days had become almost constant. At operation (Dr. Elsberg) a tumor was found in the left cerebellopontile angle.

FACIAL SPASM

Spasms of the face, which may be wrongly diagnosed as jacksonian epilepsy, may result from irritation of the facial nerve by tumors in the posterior fossa. Operations have been performed over the motor area on this account. Hughlings Jackson,⁸ in 1865, noted homolateral attacks of facial spasm which he had difficulty in accounting for. Stewart and Holmes mention them as possible though inconspicuous symptoms. Two cases are cited by Mills and Weisenberg,¹⁶ and some

16. Mills, C. K. and Weisenberg, T. H.: Cerebellar Symptoms and Cerebellar Localization, J.A.M.A. 63:1813 (Nov. 21) 1914.

slight facial twitching was present in three of Cushing's patients, in one of them bilaterally.

In our series there are three cases in which an attack of homolateral facial twitching occurred. In none was it an early symptom, and it was otherwise unlike a jacksonian attack in that it had no local point of commencement with gradual spread. It remained limited to the face. On careful consideration the spasms in these cases will be found to conform more in character to those of facial convulsive tic (facial spasm) than to those of an epileptiform attack. It is likely, too, that some associated symptoms, such as involvement of other cranial nerves, will assist in making their subtentorial origin apparent.

CASE 8.—Mc., a woman, 45 years of age, for two years had suffered with headache and vomiting. She also had had intermittent pain over the eyes and left side of the face and tinnitus with comparative deafness of the left ear of gradual development. At times during the past year she had seen dazzling lights before her eyes and had been ataxic in gait. Two months before she had had severe twitching of the left facial muscles. At operation (Dr. Taylor) a tumor was found involving the left side of the cerebellum.

CASE 9.—W., a woman, 43 years old, three years before had commenced to feel weak, dizzy and nauseated at times. A year and a half before she had begun to have tinnitus, bilateral, but especially marked in the right ear. Her hearing had become poor in this ear, and she had had neuralgic pains in the right eye and right side of the face and head. During the past year she had had much headache, generalized and severe, and her vision had rapidly failed. In the past few months the right side of her face had felt numb, and her neck large and stiff. On one occasion, three months before, the right side of her face had twitched spasmodically for five minutes, preceded by an attack of dizziness. At operation (Dr. Elsberg) a tumor of the right side of the cerebellum was found.

GENERALIZED CONVULSIONS

In not one of our forty-five cases did generalized convulsions occur, nor were any reported in Stewart and Holmes' series of forty cerebellar tumors. This should be interesting to those who have considered an epileptic convulsion to be a common general sign of intracranial tumor, attributable, like headache, vomiting and optic neuritis, to heightened intracranial pressure, for it is a well-known fact that the intracranial pressure increases early in subtentorial tumors and usually to a marked degree.

We accept the view that a generalized epileptic convulsion in the last analysis is always the expression of one physiologic state (no matter what influences entered into the production of that state)—a more or less generalized cortical instability. This is in accord with the belief expressed years ago by Ferrier,¹⁷ one of the most experienced investi-

17. Ferrier: *Allbutt's System of Medicine* 7:375, 1901.

gators of cerebellar excitability, that if a generalized convulsion occurs in connection with a cerebellar lesion, it has an indirect relationship only, and is not due to direct irritation of the cerebellum. This is also the conclusion of James Collier¹⁸ in his important paper on "The False Localizing Signs of Intracranial Tumor." He tells of "several" cases of tumor of the brain stem and cerebellum, in which general convulsions occurred, ". . . but in all these cases the symptoms were of long standing when the convulsions first occurred, and in all of them the autopsies revealed considerable ventricular distention." He considers that the convulsions were the result of internal hydrocephalus which by pressure had produced an unstable condition of the cerebral cortex. Generalized convulsions as the result of cerebellar tumor are rare, and Collier's explanation for their occurrence may be accepted.

JACKSONIAN CONVULSIONS

No jacksonian attacks occurred in any of our forty-five cases, nor were there any spoken of among the forty cases of Stewart and Holmes. Collier,¹⁸ however, calls attention to two cases in which tumor of the cerebellum caused jacksonian attacks. Local convulsions of slow spread and confined to the arm and face were observed. No lesion except cerebellar tumor was present, but the ventricles were considerably distended, and some bilateral spasticity was present. The cases were of long standing when the convulsions occurred. Collier attributes the spasms to cortical instability, the result of pressure from internal hydrocephalus. He believes that the occurrence of such attacks should not lead to confusion in localizing the tumor, if signs of intracranial pressure have long been present, for cerebellar signs will probably have been conclusive early in the illness.

CONCLUSIONS

There are nine cases only in this series of forty-five posterior fossa tumors in which phenomena occurred that might be considered under the caption of "fits." From a study of these cases and a brief review of the literature, we have concluded that convulsive phenomena of any sort in tumors of the posterior fossa are rare; that the chief distinguishing feature of those which have been noted is the irregularity and sustained tonic of the movements, in comparison with the rhythmic, clonic movements of forebrain fits.

Sudden involuntary movements, similar in a measure to the so-called forced movements which follow experimental ablation of parts of the cerebellum, were observed in some cases.

18. Collier, James: The False Localizing Signs of Intracranial Tumor, *Brain*, Pt. 14:490, 1904.

Sudden characteristic disturbances in the function of the cranial nerves in the posterior fossa, such as tic-like spasms and respiratory embarrassment, may result from irritation by a tumor in this region.

Fits of any kind usually occur late in the illness, after conclusive signs of cerebellar disease have long been present.

Jacksonian convulsions, which may result from instability induced by the growth of a tumor in the vicinity of the cerebral motor cortex, are easily distinguishable from cerebellar fits by the deliberate, progressive, clonic character of the spasms.

We wish to express our indebtedness to Dr. Elsberg, Surgeon to the Institute, for the privilege of studying the operating room records.

20 West Fiftieth Street—149 East Sixty-Seventh Street.

LUMINAL THERAPY IN THE CONTROL OF EPILEPTIC SEIZURES

IRVING J. SANDS, M.D.

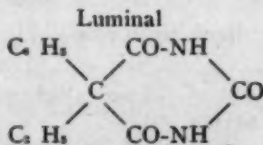
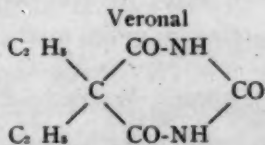
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Notwithstanding the many ingenious hypotheses advanced to explain epilepsy, it still must be assumed that it is a disease of unexplained etiology. In the present state of information, it might be best regarded as the result of an increased irritability of the cerebral cortex, occurring as an expression of organ inferiority, with the seizures as responses of this cortex to stimuli of exogenous or endogenous origin. The fact that most patients at first have nocturnal fits, then nocturnal and diurnal ones, and that there is a tendency toward an increase in the number of seizures, might best be explained on the principle that every nervous activity is enhanced by each preceding one; in other words, each epileptic seizure predisposes to the following one. While it takes considerable time for the highly irritable cortex to respond to the stimuli, when once it has responded, it is much easier for the following fit to come through; in other words, the threshold is lowered. It is therefore logical to utilize those agents that diminish the irritability of the cortex and to employ factors that minimize all stimuli. To accomplish this end is the goal of practically all who have to deal with the epileptic patient.

The drugs most frequently employed have been, in one form or another, preparations of bromid. It is true that in certain cases this drug has done good. In the vast majority of cases, however, it has failed and its after-effects have been most distressing. The picture of bromidosis is too well known to need description.

The drug that has given us most unusual results, and which we employed in the present study, is luminal. It is a phenyl-ethylbarbituric acid and is therefore closely allied to veronal.



Hauptman¹ was the first one to use this drug in epilepsy; he reported a series of cases in 1912. The dosage employed was 0.1 gm.

1. Hauptman, Alfred: Luminal bei Epilepsie, München. med. Wchnschr. 50: 1907 (Aug. 27) 1912.

in the morning and 0.2 gm. in the evening. In the milder cases, the seizures disappeared and in the severe cases they became milder in their manifestations. No postepileptic stupor followed the use of this drug, and there were no other undesirable after-effects. Many of the patients were able to return to their homes in good condition and to become self supporting.

Kutzinski² also studied a series of cases of patients with epilepsy to whom he daily gave luminal in doses of 0.1 gm. to 0.3 gm. He also noted complete disappearance or reduction in the number of the seizures, according to the severity of the case. He found luminal less efficacious in infantile epilepsy; in none of the cases was there improvement in the mental symptoms; and, as the effect of luminal was transitory, the seizures recurred on withdrawal of the drug. Nevertheless, there were no undesirable after-effects, such as reflex or pupillary disorders, cardiac or urinary disturbances.

Fuchs³ obtained satisfactory results in a series of thirty patients treated by luminal in doses of 0.075 gm., three times a day. The seizures ceased in most cases, but returned with greater intensity and frequency with the discontinuation of luminal. The best results with the drug were obtained in patients who showed a tendency to psychosis. The author concluded that luminal is the best anti-epileptic drug known at the present time.

Debrowski,⁴ choosing a series of epileptic psychoses for experimentation with luminal, found that favorable results were obtained, even in cases of long standing dementia. He gave doses of 0.1 to 0.2 gm., two or three times a day, occasionally giving 0.3 gm. twice a day. He believed there was no counter indication to its use, and no complication occurred, except that larger doses gave him unfavorable after-effects, such as drowsiness, slight ataxia and a slow scanning unintelligible speech, these symptoms clearing rapidly, however, on withdrawal of the drug.

Dercum⁵ found that luminal exercised a remarkable control over the seizures even in the most confirmed cases of epilepsy, usually inhibiting them promptly. He administered a grain and a half of

2. Kutzinski, A.: Luminalbehandlung bei Epilepsie, *Monatschr. f. Psychiat. u. Neurol.* **36**:174, 1914.

3. Fuchs, W.: Epilepsie u. Luminal, *München. med. Wchnschr.* **61**:873 (April) 1914.

4. Debrowski, W. G.: The Effect of Luminal in Epileptic Dementia, *Monatschr. f. Psychiat. u. Neurol.* **36**:248, 1914.

5. Dercum, Francis X.: On the Complete Control of Epileptic Seizures by Luminal, *Therap. Gaz.* **43**:609 (Sept. 15) 1919.

luminal, or two grains of sodium luminal at bed time, after putting the patient through a course of bromid preparatory treatment. There were no indications of any deleterious or untoward effects, and the results were most gratifying.

Our study of eighty-six cases of epilepsy covered a period of eight months, and it was limited to female psychotic epileptic patients.⁶ We did nothing to alter the general routine or the management of the patients; we merely administered sodium luminal in a definite dosage to all patients, each one receiving a sufficient amount of the drug to make an impression on the particular case. Previous to this, the patients received either bromid, hyoscin, chloral, or some other sedative to counteract the unpleasant effects associated with the seizures, such as assaultative tendencies, irritability, excitability, destructiveness, etc. We at first limited the use of the drug to fifteen of the most serious cases. These were selected either because of the unusual frequency of the seizure, or unusually distressing after-effects, such as great post-epileptic stupor, confusion, destructiveness and homicidal tendencies. Our results were so prompt and striking in this rather small group that after a month's trial we administered this drug to all patients in the epileptic group.

We used sodium luminal rather than the alkaloid itself because of its greater solubility. This has been of great advantage in our cases because many of the patients would not take medicine, and we therefore put the drug in their tea or coffee unknown to them. As a general rule, the dose employed was three fourths of a grain, three times a day, but each patient was carefully studied before a definite dosage was given. We found that while some patients required more than three doses a day, others did better on only one dose given just before retiring.

RESULTS OF ADMINISTRATION OF LUMINAL

The results obtained were striking. The first improvement noted was a decided decrease in the number of seizures. This could best be gaged when the total number of seizures in May, 1919, were compared with the number in May, 1920. There were 502 recorded seizures in May, 1919, while only eight seizures were recorded in May, 1920, in the same ward. While it is conceivable that there may have been a different and possibly a milder type of cases in 1920 than in 1919, the difference is entirely too great, even if we make such allowance. Furthermore, over 60 per cent. of the patients under our treatment were in the ward in May, 1919.

6. This study was conducted at the Manhattan State Hospital, Ward's Island, N. Y.

There was a definite diminution in the nature of the seizures, the convulsions being much milder and of shorter duration.

There was a definite decrease and change in the unpleasant after-effects of the seizures.

There was a definite favorable impression on the menstrual function of patients.

We were enabled to parole patients whom we otherwise would not have considered fit to leave the institution.

The patients became much quieter and more amenable to care and treatment.

A decided improvement in the general morale of the ward was observed. There was a decided decrease in the number of injuries received during seizures, and in the number of altercations with other patients. Less demands were made on the overworked nursing staff.

The after-effects of the drug have been practically nil. We had one case, that of a deteriorated young epileptic patient, who had as many as six convulsions in twenty-four hours. She was given luminal and was apparently doing well when we suddenly noted that she had become rather somnolent and did not respond to questions. There were no physical signs that could be attributed to the drug, such as ptosis or paralysis or sensory disturbances. She remained in that somnolent state for ten days, during which time she received no medication and had to be fed forcibly. At the end of this period the condition gradually cleared up, and she had an epileptic seizure. We then resumed the administration of the drug in diminished dosage, finally giving her three-fourths of a grain of sodium luminal every evening. She has continued to improve, has requested that she be allowed to do a little work in the ward and to go to church, and has brightened up remarkably.

There were no accumulative effects in any of the cases; there was no dulness, no exanthems, no paralysis, nothing that would lead one to believe that any of the toxic effects that have been reported by other observers were present.

This drug, however, cannot be considered free from all unpleasant results. With the discontinuation of its administration the seizures return at more frequent intervals and with greater intensity. This and the fact that as yet we are unable to explain the manner in which the drug acts would indicate that the drug should be used with caution and only by trained men. Furthermore, the margin of safety is rather small; German observers warn against the use of luminal in doses of more than 0.3 gm. in twenty-four hours. Toxic symptoms resembling those caused by veronal poisoning, drowsiness, slurring, scanning speech, paraphrasia, ataxia, dilated pupils, and gastro-intestinal symp-

toms—have been reported by Farnell⁷ and others. These observers, however, used the drug in too large a dosage and as an hypnotic to induce sleep. We believe there are much safer and more valuable drugs to be used for hypnotic purposes, because the dose required to induce sleep makes administration of luminal too dangerous. As an anticonvulsive, this drug at present is more nearly a specific one than any other we have at our disposal.

We did not neglect the generally accepted measures for diminishing the irritating stimuli sent to an easily excitable cortex; dental and eye defects were corrected and careful attention was given the bowels, the diet and bathing, as well as to the matter of air and exercise.

1198 Eastern Parkway, Brooklyn.

7. Farnell, F. J.: Luminal; Its Toxic Effects, *J. A. M. A.* **61**:192 (July 19) 1913.

News and Comment

COLORADO NEUROLOGICAL SOCIETY ORGANIZED

On December 20, the Colorado Neurological Society was organized with thirteen charter members. The officers are: president, Dr. Howell T. Pershing, Denver; vice president, Dr. Philip Work, Pueblo, and secretary and treasurer, Dr. George A. Moleen, Denver. Bimonthly meetings will be held.

Abstracts from Current Literature

ZUR KLINISCHEN PATHOLOGIE DES ZWISCHENHIRNS (CONTRIBUTION TO THE CLINICAL PATHOLOGY OF THE DIENCEPHALON. ERICK LESCHKE, Deutsch. med. Wchnschr. 46:959 (Aug. 26) 1920.

The author states that considerable controversy still exists concerning the function of the pituitary and of the diencephalon, due to their close relation. In the general discussion he recalls that Eckard pointed out that the destruction of the corpora mamillare resulted in polyuria, while in 1884 Loeb demonstrated that disease of the diencephalon caused disturbance in the heat-regulating mechanism and glycosuria. In 1891, Ott showed that by stimulation of the tuber cinerium heat regulation was altered, and in 1907 he further demonstrated that the strongest pyretic (such as tetrahydronaphthylamin) failed to produce fever after extirpation of the corpus striatum and tuber cinerium. Caselli found that by stimulation of the adjoining portion of the base of the diencephalon, following extirpation of the pituitary gland, he obtained the same results as Cyon obtained by direct stimulation of the pituitary gland, namely, slowing of the pulse, increased blood pressure, and in one case glycosuria. In this connection Winkler demonstrated that following the removal of an eye or section of the sympathetic fibers of the neck, a degeneration of certain cell groups and fiber tracts occurred in the hypothalamus.

Interest in the physiology of the diencephalon was first awakened by the work of Karplus and Kreidl in 1909. In their work, by electrical stimulation of the infundibulum, they obtained sympathetic reactions; dilatation of the pupils, widening of the palpebral fissure and retraction of the nictitating membrane. Edinger at this time also ascribed to the diencephalon sympathetic functions. Aschner, in 1912, in his exacting work on the physiology of the midbrain, was able to separate the functions of the pituitary gland from those of the diencephalon. He showed that following stimulation of the base of the diencephalon, glycosuria with polyuria, slowing of the pulse, contraction of the bladder, rectum and uterus and atrophy of the genitalia occurred. In 1916, he postulated from his work that a chemical and visceral center was present in the diencephalon, which, among other functions, had a special bearing on the clinical pathology of diabetes mellitus, insipidus, and dysplasia adipo-genitalis.

In 1912, Krehl and Isenschmidt had also demonstrated that the heat-regulating mechanism was destroyed following section of the diencephalon, while in 1913 the author obtained similar results by midbrain puncture. Leschke further was able to demonstrate that the basal medial portion of the hypothalamus contained not only the normal heat-regulating power, but, in conjunction with Citron, demonstrated that the temperature center also belonged here, for following its separation neither infection nor pyretics would cause a rise in temperature. Later, in conjunction with Schneider, the author showed that by stimulation of the diencephalon, an arrest of protein metabolism occurred. This observation corresponds with the results obtained by Graffe. Karplus and Kreidl found that the diencephalon also exerted some influence over hidrosis. Müller and Glaser assume a vasomotor center to be in the diencephalon, which

when stimulated causes increased blood pressure and constriction of vessels.

The author next reviews the work on the basal ganglions of the midbrain, referring to the work of Wilson on lenticular degeneration, Levy on paralysis agitans in relation to the caudate nucleus and ansa lentiformis, and the more recent work of Frank in relation to the tonic innervation of striated muscle which depends on the sympathetic innervation.

1. In the discussion of the anatomy of the diencephalon the author refers to the work of Edinger in which this author shows that the diencephalon, especially the basal portions, belongs phylogenetically to the older portions of the brain stem. The diencephalon is found in the lowest vertebrates, forming in them the highest center of the nervous system, just as the cortex functionates in the highest vertebrates. Edinger considers the diencephalon a part of the primary mechanism of the brain, while the telencephalon phylogenetically is of much later development. The diencephalon ganglions develop from the central gray matter which is present about the middle ventricle in lower animals (third ventricle in higher vertebrates). The author states that the regio subthalamica stands in close relation to the cortex in the phylogenetic scale. In the lower vertebrates it is anatomically and functionally the highest brain part, controls all regulatory function, and acts in the lower vertebrates as the cortex does in the higher vertebrates. Evidence to support this analogy is seen in progressive paralysis in which both are equally degenerated.

2. Diencephalon and Diabetes Insipidus: According to the work of Aschner, diabetes insipidus is not the result of pituitary disturbance, but due to function of the diencephalon. Camus, Roussy and the author have noted polyuria following destruction of the base of the midbrain. In spite of the recent work in diabetes insipidus in which so much evidence has been brought to bear on the pituitary origin, among others the experiment in which extract of this gland produces in the healthy a polyuria, the author feels that all that may be ascribed to the pituitary may also be ascribed to the diencephalon. He gives these facts to show that the pituitary alone is not the cause of diabetes insipidus: (a) Extirpation of the pituitary in animals without injury to the diencephalon does not cause a constant or even transient polyuria. Following extirpation of the posterior lobe, one does not obtain the cachexia which follows extirpation of the anterior lobe. (b) Destruction or atrophy of all or part of the pituitary in man is not followed by diabetes insipidus. Following destruction or atrophy of the anterior lobe of the pituitary gland, a characteristic cachexia develops; also loss of weight, prematurity, apathy, even coma, secondary anemia and sexual impotence. Isolated destruction of the posterior lobe is not followed by any change, the same being true for the infundibulum. The author concludes that diabetes insipidus has no relation to pituitary function.

Concerning the relation between the diencephalon, especially the basal portion, and diabetes insipidus, the author gives these facts: (a) Puncture of the tuber cinereum directly posterior to the infundibulum will produce polyuria and, in the cases of pituitary disease showing midbrain disturbances, also diabetes insipidus. There are numerous verified cases of diencephalon disturbances in which the pituitary gland was not involved and in which diabetes insipidus occurred. Such cases have been noted following (1) gunshot wounds, (2) basal tumors, (3) softening in the midbrain, (4) gumma of the midbrain, (5) tubercles of the infundibulum, (6) pineal tumors, (7) vascular lesions, and (8) internal hydrocephalus.

The occurrence of polyuria during migraine or epileptic attacks indicates a cerebral influence in diureses. The frequent occurrence of polyuria following

basal skull fracture is explained on the ground that as a rule the diencephalon is the portion that suffers. All these factors indicate that the basal (infundibular) portion of the diencephalon plays an important part in the pathogenesis of diabetes insipidus.

3. Diencephalon and Diabetes Mellitus: Against the pituitary theory of diabetes mellitus are the same points as in polyuria. (a) Extirpation of the pituitary gland or one of its lobes, if the diencephalon is not affected, does not cause diabetes mellitus in animals. (b) Change in the pituitary gland by tumor or atrophy in man does not bring about diabetes mellitus.

On the other hand, one finds that in disease of the base of the diencephalon and surrounding portions glycosuria is produced which may lead to polyuria, and the two conditions not infrequently occur simultaneously. The author found that in 42 per cent. of a group of 189 cases of acromegaly, a lasting alimentary glycosuria developed. He gives cases of basal ganglion lesions, apoplexy, basal skull fracture and basal syphilitic meningitis, in which polyuria with diabetes was present. To bear out this work, the author quotes from Borchard, Falta, Noorden and others.

As to the relation of the pancreas to diabetes, the author states that even if the pancreas is affected there is no reason to believe that the diencephalon does not also play a part. He states that in two such cases of diabetes mellitus in which disturbance in the pancreas was found, he also found changes in the diencephalon. The changes in the brain were confined chiefly to the hypothalamus. The author feels that changes in the diencephalon can be expected only in a portion of the cases of diabetes mellitus, for the diencephalon represents only one of the stations of the sympathetic system. The possibility of a sympathetic nervous system connection of the midbrain and the pancreas and liver is brought up by the author.

4. Midbrain and Dystrophia Adiposia Genitalis: Since Fröhlich in 1901 presented the syndrome bearing his name and its relation to pituitary function, it has withstood all attacks. As early as 1904, Erdheim opposed the pituitary theory in Fröhlich's syndrome. He pointed out that in several cases the pituitary gland showed neither macroscopic nor microscopic changes. He believed that adiposity resulted from a functional disturbance in a trophic center situated in the diencephalon in the region of the infundibulum. Aschner was of the same opinion, and showed that by destruction of the base of the diencephalon without injury to the pituitary gland an atrophy of the genitalia took place.

Against the pituitary theory of dystrophia adiposia genitalis, the author makes these statements: 1. In thirty-five cases of Fröhlich's disease that came to necropsy, there were at least twelve in which the pituitary gland was not involved; this is also true of two additional cases of Winkler and four of Oberndorfer. 2. In the remaining twenty-three cases a most varied form of tumors in the pituitary structure led to the syndrome. 3. Loss of pituitary function in man, when limited to the anterior lobe, is followed by characteristic cachexia (Simonds); disturbance of the posterior lobe is followed by no change.

Concerning disturbance of the diencephalon in cases of adiposia genitalis the author says: 1. In all cases of dystrophia the diencephalon is affected even if the pituitary is not involved. 2. Following isolated destruction of the diencephalon in animals, genital atrophy occurred; adiposity was not noted. 3. Destruction of the midbrain caused increased protein metabolism. Stimulation of the diencephalon, on the other hand, caused decreased protein metabolism. 4. Dystrophia adiposia genitalis is at times found in conjunction with other disturbances of the diencephalon, such as polyuria and low temperature.

The author feels that these facts point to the presence of a metabolic center in the diencephalon. The relation between the pituitary gland and the diencephalon in this disease must remain an open question.

5. *Temperature Disturbances in Diseases of the Diencephalon*: Loeb, as early as 1873, and again in 1884, called attention to the tuber cinerium in temperature disturbances. The author states that if one reviews the literature concerning pituitary tumors with or without acromegalia, one finds many cases in which there is an unusually low temperature, and in some cases, unexplained periods of high temperature. This was noted in some of Cushing's cases; he attributed the temperature change to the pituitary gland. Leschke points out, however, that in animals in which the pituitary gland is removed, or in man, in cases of atrophy of the pituitary, the heat regulating mechanism is left intact. The author states that he has frequently seen cases of pituitary tumor with rise in temperature, in which the temperature could not be explained either clinically or pathologically. Diseases of the tuber cinerium may make impossible a high temperature. As an illustration the author cites a case in which a patient with pneumonia at the onset had a temperature of 39 C., and on the following days of only 36.8. At necropsy examination it was found that the diencephalon was infiltrated with round cells and that there was an area of softening in the tuber cinerium. Max Meyer found in a case of localized encephalitis of the corpora mamillaria, besides polyuria, a temperature of 38 C. The high temperature following apoplectic seizures localized in the diencephalon and fractures of the skull with polyuria and glycosuria tend to show that the diencephalon has something to do with the heat regulation.

6. *Diencephalon and Eye*: After the removal of an eye or section of the cervical sympathetic or superior cervical ganglion, there occurs a degeneration of the falciform cell groups of the hypothalamus below the floor of the third ventricle, also of the fibers in the central gray matter under the nuclei habenulae, while stimulation of the midbrain produces dilation of the pupils and separation of the lids. These findings have not been noted in pituitary tumors, and the author believes the reason for this may be that the early involvement of the optic nerve at the chiasma overshadows the above findings.

Among other interesting cases the author quotes one of Oppenheim's, who observed in an adenocarcinoma of the pituitary gland which came to necropsy, blindness of the right eye with partial blindness in the left. The interesting feature was the fact that in the blind eye reaction of pupil remained, while in the partially blind eye the pupil reflex was lost. Oppenheim did not attempt to explain the finding, and the author thinks that the midbrain was compressed and thus led to a central disturbance.

7. *Relation of the Diencephalon to Vascular Innervation and to Hidrosis*: The author reviews the work of several authors, among others, that of Karplus and Kreidl, who showed that stimulation of the base of the diencephalon produced hidrosis. This has not been observed clinically. The hidrosis is supposed to be due to a stimulation of sympathetic fibers in the diencephalon.

The same observers were able to show that stimulation of the diencephalon caused a contraction of the blood vessels. Following the withdrawal of the stimulation, the blood vessels showed marked congestion. While these authors do not state that there is a vasometer center in the diencephalon, the author feels that his own observations in this regard are conclusive. Following the injection of tetrahydronaphthylamin he obtained contraction of all peripheral vessels and high temperature, up to 45 C., while following section of the diencephalon neither of these reactions were obtained. There is little clinical evidence of

vasomotor action of the diencephalon, but the author calls attention to Aschner's work in which he raises the question whether there is any relation between migraine and the diencephalon. The author has observed a case of injury to the base of the skull in which diabetes insipidus, transient glycosuria, vasomotor paralysis and unilateral hidrosis were present. The occurrence of migraine with polyuria, vasomotor disturbances and other disturbances of the diencephalon are also frequently noted clinically.

The author concludes that even though the clinical pathology of the diencephalon rests on a hypothetic base, and the relation of the diencephalon and pituitary gland have not been fully worked out, one cannot doubt, in the face of the evidence that has been brought forth, that alterations in the function of the diencephalon, especially of the hypothalamus, may lead to important changes in the vegetative economy, showing themselves in the form of diabetes insipidus, diabetes mellitus, dystrophia adiposogenitalis, heat regulatory changes, disturbances of pupillary reaction, hidrosis and vasomotor activity.

MOERSCH, Rochester, Minn.

REPORT OF A CASE OF EXTRADURAL AND SUBDURAL ABSCESS FOLLOWING SUPPURATING FRONTAL SINUSITIS AND OSTEO-MYELITIS OF THE FRONTAL BONE. JOSEPH H. BRYAN, Am. J. Med. Sc. 160:5 (Nov.) 1920.

This is a case report of a boy, aged 15, who gave a history of "nasal catarrh" during the preceding winter and at the first examination, Jan. 13, 1919, showed a swelling over the left frontal sinus and pus appearing beneath the middle turbinate of the left nasal cavity. His temperature was 100 to 101. The sinus was opened and a large amount of pus evacuated; then it was curetted and drained. He did well for several days, though the pus drained profusely. Two weeks later he developed an abscess of the left upper eyelid and, because of the large amount of drainage, was reoperated. A sequestrum of bone was removed from the frontal region leaving an opening into the cranium with a small point of exposure of the dura. A third operation became necessary and was performed April 15. A fruitless search was made for diseased bone to account for the profuse and continued drainage. At this time he also developed a right maxillary sinusitis. On the third day after the second operation the cavity was flushed out with boric acid solution when it was being dressed; later, headache, numbness in the right hand and thickened speech developed. These conditions, however, cleared up. On May 6, the whole left frontal region was swollen, edematous and bloody with purulent secretion from the fistulous opening. There was no headache, the temperature was normal, and the boy said he felt well. A fourth operation was performed the day following the examination, and pus was found beneath the periosteum; the bone beneath it was necrotic up to the frontal eminence. The diseased bone was removed and the cavity packed. Secretion lessened slowly, although the wound was apparently healing well. Convalescence was slow. Late in July, while dressing the wound, a probe was passed to detect diseased bone, but instead it went through the perforation into the cranium and, on being withdrawn, the secretions flowed more freely. The wound was kept open and draining during August, and the boy's general condition remained excellent, with no headaches or other symptoms. In September the wound was closed except for the fistulous opening at the inner angle of the orbit. A canula

inserted along this tract and through the perforation of the skull passed up to the vertex, following which 6 drams of pus mixed with blood were evacuated. This was done every other day with copious evacuations and the roentgen-ray, with the canula in situ, showed that the abscess was either in the frontal lobe or between the lobe and skull. Another roentgenogram taken after a 10 per cent. solution of nitrate of thorium had been injected showed a large extradural abscess. On September 25 another operation was performed, and the abscess contents were evacuated, the walls gently curetted, painted with iodine and a drainage tube inserted. Nonhemolytic streptococci were found on bacteriologic examination. Progress was favorable, and the patient was discharged in ten days. Secretion gradually subsided and by December had apparently ceased. On Jan. 5, 1920, he was reported as very ill with influenza, bronchitis and inflammation of the accessory sinuses. He recovered from this and by February 14 was in good condition, except for pallor of the skin. On February 16 he was severely ill; he had a septic appearance; his temperature was 103 F.; there was a swelling over the left frontal region, and he had severe headache. The next day he had nystagmus of the right eye, twitching of the muscles of the face, nausea and a leukocytosis of 23,000. An operation was performed that evening which revealed that the old abscess sac was filled with pus and closed off. Some necrotic bone was found and removed. The patient reacted well from the anesthetic, but remained semicomatose. There was slight drainage. On February 17 the spinal fluid showed 370 cells, but no organisms. There was some loss of motion of the right arm. Two days later there was twitching of the right facial muscles, nystagmus in the right eye, involuntary evacuations, 16,000 leukocytes, and the spinal fluid contained 49 cells, but no organisms. The twitchings then extended to the right arm and leg and convulsions set in, continuing at intervals until his death on the afternoon of the 23d. Neurologic notes made the day before death showed weakness of the entire right side of the body, a positive Kernig's sign, inability to name objects and misplacing of words. The convulsive seizures were of the focal type always beginning on the right side of the face.

Necropsy showed a thickened left dura and the left hemisphere covered with pus, with a center at the junction of the Rolandic and Sylvian fissures, at which point the brain substance was depressed. Bacteriologically this pus contained streptococci. The anterior half of the left hemisphere showed a depression of 1 cm., the pia much thickened generally and marked vascular injection.

PATTEN, Philadelphia.

PATHOLOGISCH-ANATOMISCHE UNTERSUCHUNGEN UEBER DIE
ENCEPHALITIS LETHARGICA, MIT BESONDERER BERUECK-
SICHTIGUNG IHRER STELLUNG ZUR GRIPPE-ENCEPHALITIS
(PATHOLOGIC-ANATOMIC INVESTIGATIONS IN LETHARGIC
ENCEPHALITIS, WITH SPECIAL REFERENCE TO ITS RELA-
TION TO INFLUENZAL ENCEPHALITIS). RUDOLF JAFFÉ, Med. Klin.
16:1013 (Sept. 26) 1920.

In this present article Jaffé reports forty cases. The pathologic findings in lethargic encephalitis are so well known that he does not wish to discuss them, but he wonders whether lethargic encephalitis is to be considered a specific disease entity, or whether it is possible that it is an accompanying picture of influenza.

In the author's material, males and females were about equally affected. The youngest patient was 16, two patients were over 50; most of the patients were between the ages of 30 and 50.

While agreeing in the main with those of Economo, there are points of difference, especially in the more unusual findings. The macroscopic picture is usually negative. Occasionally one finds more or less hyperemia of the membranes and brain substance, especially of the gray matter. The only other macroscopic findings are hemorrhages.

Microscopically as a constant finding the author mentions a perivascular infiltration of the smaller and larger vessels, especially in the brain stem, and most marked along the aqueduct, floor of the fourth ventricle and medulla. The remainder of the brain and the spinal cord are frequently free from change. Jaffé has not seen a single patient with lesions in other portions of the brain, in whom the portions mentioned above were not affected, and always to a more severe degree. If other portions of the brain are involved, the order as found by him is: central ganglions, spinal cord, and last the cerebral cortex; the cerebellum in his cases never showed any pathologic condition.

The infiltration is confined to the adventitia. It does not invade the brain substance. The cells are chiefly round cells with sparse protoplasm and large nuclei, rich in chromatin, in type resembling lymphocytes. The vessels are usually filled with blood, contain no white cells, and do not show changes in the intima with cell infiltration. Because of this the author feels that the infiltration is not blood borne, but that the cells are adventitial lymphocytes in the sense of Marchand. Plasma cells are rather rare. Only occasionally does the infiltration invade the adjacent brain substance.

The extent of the infiltration along a blood vessel is hard to determine without serial sections. Economo has seen cases in which the infiltration about a blood vessel in the cortex has sharply disappeared as the vessel entered the white substance. Jaffé has never noted this. He has seen an infiltration branch off and follow certain vessels while neighboring vessels were unaffected. Arteries may be affected as well as veins, the latter more frequently, however. In typical cases this infiltration is always present. Other pathologic conditions are seen but never without the vascular changes described.

The second important, and not at all rare finding, consists in the presence of hemorrhages. It is frequently found associated with the vascular infiltration, and usually about the vessels infiltrated. At times hemorrhages are noted without any indication of blood vessel change. An infiltration of the brain substance may occur more or less localized, which has also been described by Economo and Oberndorfer. The two above forms are not regularly found, being present in eleven of Jaffé's cases. In both forms altered glia cells, lymphocytes and occasional plasma cells, also infrequent polymorphonuclear leukocytes are found. These isolated infiltrations can be differentiated by the absence of a central vessel and should a vessel be contiguous it will be normal. Occasionally such an infiltration will abut a perivascular infiltration and one can distinctly see the typical round cell perivascular infiltration with the infiltration showing plasma cells and polymorphonuclear leukocytes.

The final main finding is neuronophagia. On this finding Economo lays great stress and because of it differentiates lethargic encephalitis from all other inflammatory processes of the central nervous system, with the exception of poliomyelitis. Oberndorfer does not think that neuronophagia is especially typical of lethargic encephalitis but may also be seen in other processes. Jaffé

is not certain that this is one of the important findings in the picture of this disease.

The meninges are seldom involved. The infiltration consists in round cells about the blood vessels, but the pial tissue may be invaded and hemorrhages may occur. The author states that it has frequently occurred that in relatively young people great numbers of corpora amylacea were found.

The author states that he attempted to differentiate the lethargic encephalitis cases from influenzal encephalitis cases, but it was practically impossible to determine to which group the individual case belonged, as he saw cases that came to necropsy diagnosed as lethargic encephalitis which showed a typical hemorrhagic encephalitis, while influenzal encephalitis cases showed distinct findings of lethargic encephalitis. Most of his patients gave a history of influenza. Five had influenzal pneumonia. In only three cases was encephalitis the only finding. Thus he could divide his cases into only two groups: patients with hemorrhages and patients without hemorrhages. As Economo had already mentioned the occurrence of hemorrhages, the close relationship between lethargic encephalitis and hemorrhagic encephalitis became evident. Jaffé asks the question, "Do cases of hemorrhagic encephalitis following grippe show pathologic changes similar to those found in lethargic encephalitis?" This he answers in the affirmative, for he states that there are cases in which a distinct combination of the findings of hemorrhagic and lethargic encephalitis occur. Thus he finds that several cases have come to necropsy with the clinical diagnosis of encephalitis and meningitis following influenza in which were seen macroscopically hemorrhages into the white substance of the brain, but in which microscopic examination showed typical pictures of lethargic encephalitis. The possibilities of the two conditions coexisting is brought up by the author, but the great frequency and the grades of admixture seem sufficient to the author to put the two diseases on the same basis. He feels that they are two different forms of the same disease, and that any combination of the two pictures is possible.

A rather constant finding in lethargic encephalitis is the vascular infiltration which usually occurs in the gray substance. Why this should occur is not known. The author also reports findings that are rather at variance with those previously reported. He has seen cases running a typical lethargic encephalitis course in which there was none or little infiltration, but that in numerous blood vessels many polymorphonuclear leukocytes and leukocytic thrombi were found.

Jaffé does not believe that one can consider lethargic encephalitis as a disease picture *sui generis*. Clinically the symptoms are variable. The lethargic is only the predominating symptom in a portion of the cases; frequently, it is absent entirely. Motor symptoms, twitchings, chorea, myoclonia, etc., may be present. In two cases of chorea gravidarum, findings typical of lethargic encephalitis were obtained. Homen has recently investigated a series of non-purulent infectious toxic cases of encephalitis in which there were no findings not present in lethargic encephalitis. The author believes that one can come to only one conclusion, namely, that other toxic encephalitides may produce the same picture as lethargic encephalitis and that lethargic encephalitis is also of toxic infectious origin. Jaffé does not believe that Economo's experiment with monkeys is conclusive. In this experiment Economo obtained a hemorrhagic encephalitis by the intradural injection of pleomorphic streptococci. In spite of this the author does not feel that from the pathologic-anatomic

standpoint lethargic encephalitis is to be considered as an isolated picture. He sees in it an infectious toxic encephalitis which may occur after any infectious disease. In conclusion, the author states that while lethargic encephalitis presents a fairly typical picture, it cannot be distinguished from the hemorrhagic encephalitis of influenza or other forms of toxic infectious encephalitis, and that the general term infectious encephalitis might better be used, appending the name of the exciting disease, whether pneumonia, typhoid or influenza.

MOERSCH, Rochester, Minn.

TWELVE CASES OF THROMBOSIS OF THE CAVERNOUS SINUS.

J. JULIAN CHISHOLM and S. SHELTON WATKINS, Arch. Surg. 1:483 (Nov.) 1920.

From a study of 50,000 surgical histories, the authors report twelve cases of cavernous sinus thrombosis, giving a detailed account of the onset of symptoms, etiology, physical examination on admission including examination of the blood, urine, teeth and tonsils, course in the hospital, treatment, result and necropsy findings when necropsy was granted.

The anatomy of the venous supply of the head is reviewed, especially the relation of the cavernous sinus to the lateral, petrosal and longitudinal sinuses, the ophthalmic vein, pterygoid plexus and the facial vein. The authors also point out its relationship to the cranial nerves, sphenoidal sinus and pituitary body. A knowledge of this anatomy gives a clearer insight into the clinical symptoms which result from an obstruction of the cavernous sinus.

The three most common causes of thrombosis of the cavernous sinus are: (1) marasmus, (2) trauma, and (3) infection. The latter is by far the most usual, and was the cause in all twelve cases reported.

Septic thrombosis usually begins with phlebitis, after which the regular phenomena of thrombi develop, with a red, adherent friable mass occluding the lumen, which may become purulent. The walls become thickened. Usually both cavernous sinuses become involved, but one before the other. There may be a basilar meningitis, meningeal hemorrhage, brain abscess and emboli involving the lungs, spleen, kidneys and other parts of the body. Usually there is more or less infection of neighboring vessels and nerves.

Symptoms of cavernous thrombosis may be due to (1) venous obstruction, (2) involvement of neighboring nerves and (3) general sepsis. Those due to venous obstruction are exophthalmos, edema of the retina, eyelids and bridge of the nose. Both eyes may be affected, but usually one is affected before the other, the second within forty-eight hours after the first. Symptoms may almost entirely disappear in one eye, while developing in the other. Associated with retinal edema, there is usually tortuosity and dilatation of the veins, retinal hemorrhages, and at times a low grade choked disk. Clouding of the media and opacity of the cornea occur shortly after the onset of eye symptoms. Edema of the lid may be so great as to close the eye completely.

When the pterygoid plexus is affected, edema of the pharynx and tonsil on the same side results; and edema of the skin over the mastoid and neck occurs when the lateral sinus and jugular vein become thrombosed, and edema of the face, when the facial vein is involved.

Cranial nerve symptoms are: ptosis, restricted ocular movements, dilatation of the pupils, loss of vision, and pain in the head due to the ophthalmic division of the trigeminal nerve. Ptosis and restricted ocular movements are due to paralysis of the third, fourth and sixth cranial nerves, while pupillary

symptoms may be due to paralysis of oculomotor or stimulation of sympathetic.

The septic symptoms are: temperature ranging usually from 101 to 106 F., rapid, small and thready pulse, chills and sweats. Vomiting, delirium and coma may also be present. Other symptoms are those of meningitis, pulmonary embolism, infection of the kidneys, liver and spleen.

Sometimes the symptoms of thrombosis are masked by those of the focal infection, especially when it begins in the orbit, when there is edema, exophthalmos, etc.

Diagnosis is based on a history of chills, headache, septic temperature and an exophthalmos, that always begins on one side, but usually involves the second eye within from twenty-four to forty-eight hours.

Erysipelas, cellulitis of the orbit secondary to nasal sinus infection, and tumors of the orbit may at times simulate septic thrombosis of the cavernous sinus, when only one eye is involved.

Treatment consists in the removal as soon as possible of the focus of infection. There is a wide difference of opinion about operating on the cavernous sinus itself, as only 7 per cent. of the patients recover without operation and less than 7 per cent. with operation. The principal methods of operation are: (1) by the temporal route, (2) by the orbital route, (3) by the ethmoidal-sphenoidal route, and (4) through the antrum of the opposite side.

The authors thus summarize their findings:

1. Operation was not attempted in any of the cases reported.
2. If operation is to be attempted the choice of route to be employed should depend on the focus of infection, whether in the orbit, ethmoid or sphenoidal cells, etc.
3. Failure of surgical intervention is due to the fact that basilar meningitis and thrombosis of the neighboring venous sinuses usually occur early in the disease.
4. Lumbar puncture is important, as often there are meningeal symptoms with a clear fluid. If the fluid is clear there is some chance for the patient without an operation, whereas if examination of the spinal fluid reveals the presence of a septic meningitis, the mere draining of the cavernous sinus will be of no avail.

SCARLETT, Philadelphia.

A STUDY OF THE RELATION BETWEEN THE REPRODUCTIVE
ORGANS AND DEMENTIA PRAECOX. T. MATSUMOTO, J. Ment. Sc.
66:414 (Oct.) 1920.

Sir Frederick Mott presents for the author an unusually interesting histologic study of the testicles and seminal vesicles in 100 cases of mental disease. The psychoses were well distributed, including defective states, paresis, manic-depressive psychoses, senile dementia and dementia praecox. The findings in dementia praecox were important enough to be repeated in detail.

"Numerous specimens of testes were examined from twenty cases of this disease. They may be divided into three groups, roughly speaking, according to the time between onset of symptoms (as far as could be ascertained) and death. This examination led to the general conclusion that the earlier the symptoms came on and the longer their duration before death, the more pronounced were the histologic changes.

In the first stage of regressive atrophy only a few of the tubules show morbid changes, the most obvious being a diminution in size and fewer spermatogenic

cells, with fewer cells showing active nuclear mitosis, absence of spermatids and spermatozoa. The Sertoli cells are seen much more distinctly resting on the thickened basement membrane. The interstitial tissue in the region of the atrophied tubules, generally speaking, is correspondingly increased. The interstitial cells containing lipoid granules can be seen and numbers of lipoid granules are observable in the Sertoli cells.

In the second stage many more tubules are similarly affected, but there may still be some tubules showing all stages of spermatogenesis. Examined with an oil-immersion lens the heads of the newly formed spermatozoa, both in the first and second stages, show appearances suggestive of degeneration. They are often of irregular shape and staining reaction; they present appearances like the degenerated forms described by Sir Frederick Mott as occurring in the fluid from the vesiculae seminales of cases of dementia praecox. Often they have an oxychromatin instead of a basichromatin reaction with the hematoxylin and eosin dyes. In fact, there appears to be a general deficiency of the basichromatin reaction of the nuclei of the spermatogonia and spermatocytes in all the tubules in this second stage.

In the third stage, which constituted the greater number of the twenty cases examined, there is almost complete or quite complete arrest of spermatogenesis. In the most advanced cases (and they are especially those which were admitted to the asylum in very early adolescence) the tubules show a very thickened basement membrane and no spermatogenic cells; a few Sertoli cells are seen within the tubule and an empty sustentacular network. Stained with Scharlach R., numbers of large, coarse droplets of fatty matter of various sizes are seen in the spaces. The interstitial cells of Leydig can be seen in the first two stages containing fatty droplets, but they appear to be less numerous and less distinct in their outline than those seen amidst the atrophied tubules in the testes of general paralytics. In the third stage, the cells of Leydig are still more difficult to find and the interstitial lipoid is less observable. The interstitial connective tissue in some of the cases has undergone proliferation, and it is not uncommon to find therefore a fairly large testis in which there is a complete regressive atrophy of the spermatogenic cells. In other cases there is no interstitial connective-tissue proliferation. In all the cases, however, there is thickening of the basement membrane, and instead of one layer of flattened nucleated cells there are several.

The microscopic picture in the other psychoses was much less significant and contrasted strongly with the schizophrenic findings. The cases of paresis and senile dementia are especially valuable as controls against the influence of advanced age and various terminal conditions. The inference is that there exists in dementia praecox a primary regressive testicular atrophy which is distinctive and does not occur in other psychotic states. This seems to be a strong conclusion, but is justified by the author's careful work. Two explanatory hypotheses are presented: First, there are biochemical changes in the reproductive organs and nervous system, probably of nuclear origin and dependent on a germinal inborn defect of nuclear durability. Second, a defect in the germ cells may lead to a disorder of the balance of the endocrine functions, resulting in a disturbance of the normal nutritional equilibrium of the neurons with hypofunction and decay. To the reviewer this seems the more plausible. In any event, there is a new argument in favor of the essentially organic nature of dementia praecox.

STRECKER, Philadelphia.

LA PARALYSIE GENERALE EST DUE A UN TREPONEME DISTINCT DE CELUI DE LA SYPHILIS BANALE (GENERAL PARESIS IS DUE TO A DISTINCT TREPONEMA). A. MARIE and C. LEVADITI, Rev. de méd. 37:193 (April) 1920.

The authors recall that the likelihood of the development of general paresis, in a case of syphilis, is in inverse proportion to the occurrence of peripheral ectodermic reactions. Fournier has concluded that general paresis follows, in a habitual quasicontant fashion, the syphilis of benign initial type. The authors have previously detailed many examples wherein the appearance of tabes and general paresis was found in subjects infected with syphilis from a known common source. Erb cites an instance in which five men, infected by the same prostitute, all became either parietic or tabetic. Nonne, Brosius, and Babinski have reported similar observations. From such observations, one can deduce, at least, the theory of a neurotropic form of syphilis with a special nerve tissue affinity.

In general paresis, there is the constant presence of *Spirochaeta pallida* in the cerebral cortex and its frequent existence, though probably intermittently and ephemerally, in the blood and spinal fluid. The authors have succeeded in causing three successive passages of the virus of general paresis in rabbits. They used the blood of a parietic patient for the initial inoculation. Results obtained with brain substance and with spinal fluid from parietic cases are also mentioned. With initial virus from a chancre they have obtained, in rabbits, the regular passage of infection over a period of six years. The following important differences between the neurotropic virus and the dermatropic, are discussed:

1. The inoculation period in the inoculation from man to rabbit ranged from forty to forty-five days with an average of forty-two with the dermatropic virus, while with the neurotropic virus it was ninety-five days as an average.
2. The incubation period in the inoculation from rabbit to rabbit averaged fifteen days with the dermatropic and seventy-five with the neurotropic virus.
3. The lesion produced with the dermatropic was an indurated chancre with microscopically intense infiltration, abundant connective new formation, a network of spirochetes at the base of the lesion and endo-arteritis and peri-arteritis. In contrast, in the neurotropic virus lesion, there was slight infiltration, no new formation of connective tissue, spirochetes in the epithelial layers, and only slight ulceration and desquamation of the epidermis.
4. The dermatropic virus, obtained originally from a chancre, inoculated into a rabbit, is transferable to monkeys. The neurotropic virus, obtained from the blood of a patient with general paresis, inoculated into a rabbit, is not then transferable to monkeys.
5. The dermatropic virus passed into a rabbit is transversible to man, as has been demonstrated by two accidental happenings. The neurotropic virus passed into a rabbit is not then transferable to man, as a voluntary attempt at inoculation showed.

Furthermore, the authors have found that rabbits inoculated with the dermatropic virus later became immune to that virus, but retain susceptibility to the neurotropic virus, and vice versa.

Judging by the results of these experiments and observations, the authors believe that the spirochete of general paresis must be considered as a different variety than the spirochete causing cutaneous and visceral syphilis.

DAVIS, New York.

REMARQUES SUR LE TRAVAIL DE M. LAFORA-TRAITEMENT INTRARACHIDIEN DES AFFECTIONS SYPHILITIQUES ET PARASYPHILITIQUES DU SYSTEM NERVEUX (REMARKS ON THE WORK OF LAFORA-INTRA-ARACHNOID TREATMENT OF SYPHILITIC AND PARASYPHILITIC CONDITIONS OF THE NERVOUS SYSTEM). G. MARINESCO, *Rev. Neurol.* 26:901 (Dec.) 1919.

The author reports having obtained excellent results in the treatment of tabes and general paresis, particularly in early cases, by the subdural injection of autogenous serum arsphenamized *in vivo*.

Marinesco's technic may be outlined thus: From 75 to 90 cg. of neo-arsphenamin are administered to the patient intravenously, provided there is no history of seizures or evidence of cardiac or renal complications. After a period, varying from several hours to three days, 30 c.c. of blood are withdrawn and, without centrifugation, are set aside in the refrigerator overnight. The serum (from 10 to 15 c.c.) is then separated and, after inactivation, is injected subdurally, an equal quantity of spinal fluid having first been withdrawn.

Three protocols are submitted. In the first case, that of a woman, aged 33, with a history of syphilitic infection ten years previously, there was noted, prior to treatment, change of character, irritability and expansiveness, speech defect, tremor of the tongue, lips, and hands, writing defect, unequal pupils with loss of reaction to light, and hyperkinetic tendon reflexes. The spinal fluid showed positive Wassermann reaction, pleocytosis and increased solids. Six injections (10 c.c.) of auto-arsphenamized serum were administered at intervals of a week, and the course was repeated after three months. Following this, it was noted that the mental disturbance had apparently disappeared entirely, and the patient was able to resume her former occupation (photographic retouching). The spinal fluid Wassermann reaction was now but feebly positive, and there was no longer evidence of pleocytosis or increased solids. The pupillary changes, however, persisted. The patient, at the time of writing, had been under observation five years without return of symptoms.

In the second case, a man, aged 35, also with history of syphilitic infection ten years previously, there was observed marked depression with hypochondriacal features. The spinal fluid showed lymphocytosis, increased solids, and a positive Wassermann reaction. After two courses of six injections, as in the first case, there was noted apparently complete abatement of mental symptoms and marked diminution in the spinal fluid cell count (40 to 5) and solids content, although the Wassermann reaction showed no change. The patient was able to resume his occupation (physician). Four years later, while in army service, the patient suffered a relapse which terminated fatally. During the latter period he had apparently not been under the author's care.

In the third case, that of a man with syphilitic infection of long standing (age and specific duration not given), there was remarked, prior to treatment, elation of the expansive type, pupillary irregularity and tremor of the hands. The spinal fluid Wassermann reaction was positive, and there was marked lymphocytosis (270) and increased solids. After two courses of injections, as in the other two cases, the mental symptoms seemed to have greatly subsided, and the cell count was reduced to 12. The spinal fluid Wassermann reaction was now only weakly positive, and the increase in solids radically cut down. As this patient came under treatment only a short time prior to the preparation of this paper, no opportunity was afforded for observation as to the permanency of the improvement.

RAPHAEL, Kalamazoo, Mich.

ETUDE ANATOMO-PATHOLOGIQUE DES CENTRES NERVEUX
DANS UNE CAS DE MYXOEDEME CONGENITAL AVEC
CRETINISME (THE STUDY OF THE PATHOLOGIC ANATOMY
OF THE CENTRAL NERVOUS SYSTEM IN A CASE OF CON-
GENITAL MYXEDEMA WITH CRETINISM). PIERRE MARIE,
C. TRÉTIKOFF and E. STUMFER, *L'Encephale* 15:601 (Nov.) 1920.

The authors have undertaken a microscopic examination of the brain of a typical cretin in whom the thyroid was quite absent, being replaced by two cysts, each about the size of a hazelnut. The patient was well oriented, but was unable to read or write. She had been at the Salpêtrière six years. She was able to make her bed but was unable to do any work, such as knitting, sewing, etc. She died of an infectious diarrhea at the age of 36.

The authors were unable to make a thorough examination of the more delicate structures of the central nervous system, since the tissues had been in formaldehyd for over a year. The lesions which they were able to show consisted of a marked infiltration of the walls of the blood vessels of all calibers by an amorphous substance, colored dark-violet by hermatein. This substance was either a compound of iron or calcium. By means of the reaction of Perls, the authors demonstrated that the coloration was due mainly to iron compounds.

Changes were found in the cerebellum, dentate nucleus and the lenticular nuclei. Examinations of sections of various other parts of the cerebral hemispheres, the oval center of Vieussens, pons, cerebral peduncles, medulla and spinal cord showed no changes. The authors suggest that this may have been due to the age of the specimen and the consequent technical limitations.

The walls of the blood vessels of these structures (cerebellum, dentate nucleus and lenticular nuclei) were infiltrated by the dark staining granules mentioned in the foregoing. The granules in some cases were as large as red blood cells. In the globus pallidus, the knee of the internal capsule, and the inner third of the putamen the lesions were most conspicuous. No area of softening was found.

In conclusion, the authors ask whether the accumulation of iron may not be related to the hypothyroidism. They emphasize the important part that iron plays in oxidation. They also mention the chromatolysis found throughout the nervous system by Mott and Bruns, and correlate this with the work of Marinesco, who showed that the chromatophil bodies contain much iron. They feel that the question is a difficult one and necessitates a solution by the biochemists.

The authors feel that their observations throw light on the origin of the cerebellar symptoms described in myxedema by Odien. They believe that the marked variations in the degree of mental impairment in many cases may be explained by the intenseness and localization of the vascular lesions.

KRAUS, New York.

INFANTILE SPINAL PROGRESSIVE MUSCULAR ATROPHY
(WERDNIG-HOFFMANN). REPORT OF A CASE WITH
NECROPSY FINDINGS. E. J. HUENEKENS and E. T. BELL, *Am. J.*
Dis. Child. 20:496 (Dec.) 1920.

The literature on infantile progressive muscular atrophy is reviewed and the clinical and pathologic pictures of the Werdnig-Hoffmann type are contrasted with the amyotonia congenita of Oppenheim. The conclusions formed,

in general, are that the two diseases are extreme grades of one and the same disease, having the same type of pathologic alterations in muscle and spinal cord, but varying clinically in some respects and with many gradations.

The following case is reported: There was myopathic disease on the mother's side in three first cousins, but the paternal history was negative. The first child, aged 8, was healthy; the second, died at 3 months of age, having given evidence of myotonia at birth; the case of the third child is reported; the fourth, aged 1, was normal.

The patient was born at full term, and appeared normal until the age of 6 weeks when its movements began to grow weaker, especially at the hips; the arms were later involved, and the whole condition progressed gradually. At 4 months, breathing and nursing were difficult. The authors saw the case for the first time when the child was 5 months old. He was underdeveloped and undernourished, with a flabby musculature, pale skin, and difficult breathing; the chest was deformed; the knee jerks were absent, and he had frequent spells of collapse. A mediastinal growth was suspected; later it was found that he had an enormously enlarged thymus. The child died at the age of 6 months.

NECROPSY REPORT: Atrophic muscles, enlarged thymus—extending to the diaphragm, distinctly lobulated, and weighing 29.5 gm.; lungs markedly collapsed; suprarenals greatly reduced in size and weight; other structures negative grossly.

MICROSCOPIC EXAMINATION: The spinal cord showed a few atrophic cells in the anterior horns in the cervical region, marked decrease of cells in the anterior horns in the dorsal and lumbar regions, and the few cells present were atrophic. There were no hemorrhages and no lymphatic infiltration. There was moderate reduction of the medullary sheaths in the fasciculus gracilis. The muscles showed distinct atrophy, with atrophic fibers intermingling with the normal. The thymus was hyperplastic and the lungs atelectatic.

The interesting features are that the case is familial and hereditary, and a typical Werdnig-Hoffmann type. The second child had a case of true amyotonia congenita of the Oppenheim type, showing that the two types existed in the same family, thus leading further to the establishment of the contention that the two diseases are merely extreme grades of the same disease.

PATTEN, Philadelphia.

ARTHRITES AIGUES PLASTIQUES ET MENINGITE CEREBRO-SPINALE A MENINGOCOQUE C (MENINGITIS, MENINGOCOCCUS TYPE C, WITH ACUTE PLASTIC ARTHRITIS). R. J. WEISSENBAACH and L. MERLE, *Progrès méd.* 35:527 (Dec. 4) 1920.

The apparition of articular phenomena in the course of epidemic cerebro-spinal meningitis has been described by several writers, and the meningococcus has been isolated from affected joints by Fronz. The clinical aspect of the arthropathies have included an arthralgic form, a hydrarthritic as well as a hemarthritic form and a suppurative form. The author reports a case in which the arthritic signs did not correspond to any one of the above. Instead there was clinically what the author calls a plastic arthritis, quite like an acute gonorrheal arthritis. The changes were entirely peri-articular, with local redness, heat and tenderness; there was no fluctuation.

The report concerns a woman of 23 ill with epidemic cerebrospinal meningitis, due to meningococcus type C, as shown by culture of the spinal fluid.

who forty-eight hours after the appearance of meningeal symptoms developed an arthritis of each wrist joint. Six days after the disappearance of meningococci from the spinal fluid, a third articular localization, of the left shoulder joint, developed, accompanied by a return of fever. The patient made a complete recovery by the end of fifteen weeks.

DAVIS, New York.

AMYOTONIA CONGENITA (OPPENHEIM). REPORT OF A CASE, WITH FULL HISTOPATHOLOGIC EXAMINATION. JAMES B. HOLMES, *Am. J. Dis. Child.* 20:405 (Nov.) 1920.

The author reviews the literature on the subject with special reference to the underlying pathology. He concludes that "the significant lesion seems to lie in the cells of the anterior horns, in the large motor ganglion cells, and that most distinctly in those regions where these cells normally reach their greatest development, i. e., in the cervical and lumbar regions."

The case is reported fully and gives clinically a typical picture of amyotonia congenita as described by Oppenheim in 1900. The necropsy findings were the interesting features of the paper. The diaphragm was the only muscle appearing normal grossly and microscopically. In the nervous system the cord showed anterior roots diminished in size with a ratio of 1:3 and 1:4 with the posterior roots (normally 1:2), but otherwise normal configuration and size of the cord itself. Microscopically no evidence of recent degeneration or absence of myelinization was found. The cells of Clark's columns were normal, but the anterior horn cells were few in number and smaller in size, although having a normal appearance in other respects. The glia cells showed no increase. The neurofibrillae in the anterior gray matter were somewhat diminished. The posterior roots were much better myelinated than the anterior, but no degenerative changes were seen. The peripheral nerves appeared normal. In the muscular system bundles containing small immature fibers, hypertrophied fibers and collections of cells resembling embryonic muscle structure, were found in the same muscles, but there was no evidence of degeneration or increase of adipose tissue.

The author comments on the absence of evidence of disintegration of muscle tissue, and considers the possibility of the presence of either a simple atrophy or, of "an example of retarded development." As the condition was present at birth (evidenced by impaired movement), all other factors in the production of atrophy can be ruled out except abnormal innervation. The striking pathologic feature—hypertrophied muscle fibers, and collections of small cells (embryonic), side by side in the same muscle shows a lack of uniformity of structure. In addition, the inability to demonstrate replacement tissue, strengthens the point of view that the whole is a defective developmental process.

PATTEN, Philadelphia.

LE HOQUET EPIDEMIQUE (EPIDEMIC HICCOUGH). SICARD and PARAF; SUR QUELQUES CAS DE HOQUET PARAISSANT EPIDEMIQUE (CASES OF APPARENTLY EPIDEMIC HICCOUGH), LOGRE and HEUYER; reported by MME. ATHANASSIO-BÉNISTY from the *Soc. de Neurol.*, meeting of Dec. 2, 1920; *Presse méd.* 28:901 (Dec. 11) 1920.

Sicard and Paraf reported a series of twenty-two cases of hiccough collected over the preceding fortnight. Hiccough began suddenly with a minimum

of constitutional symptoms, continued almost without remission but with frequent exacerbations at all hours of the day or night, and finally ceased entirely without complications after two or three days.

Physical means of relieving or lessening the spasm were rhythmic traction on the tongue, pressure on the eyeball, mechanical distention of the esophagus, or an icebag over the course of the phrenic in the neck. Dufour showed several similar cases last year, at the time of Sicard's communication on myoclonic encephalitis. It was notable that this epidemic of hiccough was apparently paralleled by some recrudescence of epidemic encephalitis.

Logre and Heuyer called attention in their series to a nasopharyngeal catarrh, which seemed to precede the phrenic symptoms through a period of from twenty-four to forty-eight hours. The hiccough was intractable to therapy, interfered with eating but finally ceased during sleep, and lasted altogether about two days. The syndrome included some gastro-intestinal disturbances, fatigability, anxiety, and a slight febrile reaction. The rapid multiplication of similar cases suggested an epidemic infection, conceivably a benign phrenic type of influenza.

HUDDLESON, New York.

SCLERODERMA AS A POSSIBLE MANIFESTATION OF CHRONIC ARSENIC POISONING. SAMUEL AYRES, JR., Arch. Dermat. & Syph. 2:747 (Dec.) 1920.

Three cases of diffuse scleroderma were investigated, and in each instance contact with arsenic was established over varying periods of time although scleroderma began in one case before the exposure. Examination revealed arsenic in the urine of each patient. The typical lesion of scleroderma was determined in each case and reported fully. The duration of the disease is interesting in consideration of the possibility of arsenic acting as the etiologic factor; one year, four years and thirteen years, respectively. The etiology of scleroderma, so far as is known, is briefly discussed. The possibilities of arsenic are taken up, mention being made of lack of data concerning the frequency of finding of arsenic in the urine of people under ordinary conditions or suffering from some disease unrelated to arsenical poisoning. It is pointed out that urine will show arsenic from three to nine months after exposure and it is also observed that the chemical is intermittently excreted by the kidneys even in fatal cases. In the Massachusetts General Hospital arsenic was found in twelve out of twenty-five cases, 48 per cent., where arsenic was not suspected as a cause for symptoms, and in 43 per cent. of forty-eight specimens of urine collected at random.

The sources of arsenic poisoning are interesting. Arsin gas, which is highly toxic, is a frequent offender, being generated by the growth of certain species of molds on decaying wall paper, bread crumbs, etc. A similarity of symptoms common to generalized scleroderma and arsenical poisoning are: neuritic manifestations—numbness, tingling, soreness, etc.; pigmentation; changes in the skin itself; loss of weight; muscular weakness; intermittent, irregular fever; gastro-intestinal disturbances; vasomotor instability and rapid and irregular heart.

The author suggests that cases of scleroderma be studied from this point of view with the idea of establishing the exact etiology of the disease and also the investigation of arsenical poisoning as a "possibility."

PATTEN, Philadelphia.

The mother was syphilitic and a paternal uncle is reported to have suffered many years with what is described, somewhat indefinitely, as a "painful affection of the spinal cord."

Paulian directs attention to the resemblance borne by his cases to the clinical picture presented in hereditary cerebellar ataxia, but, in view of the absence of definite history of heredity, chooses to designate the condition exemplified by his cases as familial pyramidocerebellar dysgenesis, emphasizing, at the same time, the possible etiologic importance of parental syphilis in the production of the disturbance.

RAPHAEL, Kalamazoo, Mich.

ISCHEMIC NECROSIS OF THE HEART MUSCLE IN AN EPILEPTIC PATIENT DYING DURING AN ATTACK. GRUBER and LANG, Arch. f. Psychiat. 61:99, 1919.

The authors report the case of a soldier who following an epileptic attack had been placed for observation in a hospital. Death occurred a few days later, six hours after a convulsive attack in which there was extreme irregularity of the heart. Necropsy revealed a comparatively recent ischemic necrosis of the heart muscle without changes in the coronary arteries or elsewhere in the heart. The opinion is advanced that the necrosis resulted from a spasm of the coronary arteries that probably had some relation to the epilepsy. The authors comment on the fact that not infrequently aurae and strange sensations referable to vessel spasm occur. Some observers have spoken of a "vasomotor aura," and have regarded the precordial sensations occurring in epilepsy as a direct expression of vasomotor constriction. Attention is directed to the occurrence of angiospastic conditions in neuropathic persons, such as Raynaud's disease and cases of gangrene of the skin, not infrequently seen during the war. Similar vascular spasms seem to be the cause of some cases of gastric and duodenal ulcers. The cause of the angiospasm in these conditions is central or reflex. In epilepsy it is not unlikely that the excessive nervous discharges may involve the central vasomotor apparatus.

BARRETT, Ann Arbor, Mich.

L'ABOLITION DU SIGNE DE BABINSKI PAR LE FROID ET SA REAPPARITION PAR LA CHALEUR (ABOLITION OF THE BABINSKI SIGN BY COLD AND ITS REAPPEARANCE AFTER HEAT). NOICA and A. RADOVICI, Rev. Neurol. 26:891 (Dec.) 1919.

The authors report a positive Babinski reaction in a hemiplegic patient following the application of heat (hot-water bottle and immersion in heated water) to the foot although, on initial examination, the patient's feet having been somewhat chilled and cyanosed at the time, the response was consistently negative. Following the application of cold (ethyl chlorid), it was found that a positive response was no longer obtainable.

In two other cases, with uniformly positive Babinski reaction, the first that of a hemiplegic patient and the second that of a paraplegic patient, in which there had been determined, in addition, complete anesthesia extending from the soles to the level of the nipples, Noica and Radovici were able definitely to abolish the Babinski sign, for the time being, through the application of cold (ethyl chlorid) to the plantar surfaces. In the discussion of this last case, in which positive Babinski response was associated with predetermined anesthetic change, attention is called to the possibility of dissociation between conscious and reflex sensibility.

No mention is made as to whether or not the so-styled normal plantar flexion response was determined in the first case, prior to the application of heat and, in all three, subsequent to the application of cold.

RAPHAEL, Kalamazoo, Mich.

INVOLVEMENT OF THE NERVOUS SYSTEM DURING THE PRIMARY STAGE OF SYPHILIS. UDO J. WILE and CLYDE K. HASLEY, J. A. M. A. 76:8 (Jan. 1) 1921.

The results of the examination of the spinal fluid during the primary stage of syphilis should be of considerable interest to neurologists. Of 221 fluids, forty-nine gave slight but unmistakable evidence of involvement of the central nervous system. In eight there was a positive Wassermann reaction; in twelve a pleocytosis and in twenty-five increased albumin and globulin. Since the fluid changes promptly disappeared under intravenous therapy, the authors infer merely a transitory meningeal roseola. The ease with which the early nerve involvement clears up under treatment, and the stubbornness with which it resists in late syphilis, again places strong emphasis on the necessity not only of thorough but of prompt treatment.

STRECKER, Philadelphia.

EXISTE-IL DES TROUBLES IRRITATIFS EN PATHOLOGIE NERVEUSE ET MENTALE? (ARE THERE IRRITATIVE DISTURBANCES IN NERVOUS AND MENTAL PATHOLOGY?) D. TRIANTAPHYLLOS, Rev. Neurol. 26:881 (Dec.) 1919.

The author concludes that there does not exist a specific neuropathologic lesion type corresponding to the so-called "irritative lesion," which has been held by some to manifest itself in augmented neuropsychiatric function, as opposed to the "destructive" type, which tends to abolish function in the part or area involved. All lesions, Triantaphyllos contends, are essentially destructive in nature and tend, primarily, to bring about abolition of function but, on the other hand, they may secondarily give rise to "irritative" phenomena through the diminution or loss of the inhibitive control normally exercised over outlying centers by the areas actually involved in the destructive lesions. In other words, irritation, in the author's conception, represents not a primary "irritative" augmentation of function but rather a secondary disturbance of structurally uninvolved areas due to release from normal inhibitive control.

RAPHAEL, Kalamazoo, Mich.

UEBER DIE ERGEBNISSE DER PSYCHIATRESCHEN UND NEUROLOGISCHEN UNTERSUCHUNGEN AUF EINER KRANKENSAMMELSTELLE (THE RESULTS OF PSYCHIATRIC AND NEUROLOGIC EXAMINATIONS AT A HOSPITAL CENTER). HANS BERGER, Monatschr. f. Psychiat. u. Neurol. 47:335 (June) 1920.

The report deals with observations made in 1915 at a hospital center close to the front which received its patients directly from combatant units. In the nine months covered by the report, there were 12,218 admissions; of these, 971 had mental or nervous disorders. Among the groupings are: dementia praecox, 17; depressive states (including melancholia, exogenic depressions, etc.), 34; manic depressive states, 8; paranoia, 2; severe constitutional psychopathic states, 2; chronic alcoholism, 29; genuine epilepsy, 48—34 of these

patients had had previous attacks, whereas 14 developed the first attack in the field. In the latter group, there was no hereditary factor noted. Probable genuine epilepsy was found in 47; traumatic epilepsy, 30; neurasthenia, 179 (the majority being constitutional neurasthenics); nervous exhaustion, 45; neurasthenic symptoms of undetermined origin, 65; mixed organic cases (multiple sclerosis, myelitis, etc.), 55; hysterias (developing without sudden fright), 56; conditions attributed by the patient to shock caused by an exploding bomb, hand grenade, etc., 233. Of these, 130 showed hysterical manifestations and 103 neurasthenic symptoms.

Of the 971 cases, functional nervous disorders comprised 592, or 60 per cent. The number of cases of acute onset, due to sudden fright were 233, or 24 per cent.

The author brings out an interesting relationship between the time of onset of the functional cases and the epilepsies in relation to active combat. The functional cases develop immediately; cases of epilepsy, after an interval. During a period of active fighting, the peak of admissions for epilepsy came one week after the peak of admissions for hysteria.

SELLING, Portland, Ore.

THE EFFECT OF MERCURY SALICYLATE ON THE WASSERMANN REACTION: OBSERVATION ON THE SEROLOGY OF EIGHTY-SEVEN PREVIOUSLY UNTREATED MEN. HERMAN GOODMAN, Arch. Dermat. & Syph. 2:193 (Aug.) 1920.

This is a group study of the effect of mercury salicylate on eighty-seven patients who had never received treatment, and all of whom gave a positive Wassermann reaction. The patients received 1 grain of the drug at weekly intervals for a period of from six to eight weeks, and the second Wassermann test was made at the end of the first four weeks of rest. The results were: 47 patients showed no change; the reaction in 5 advanced from +++ to +++++; the reaction of 7 was reduced from +++++ to ++++; the reaction of 1 was reduced from +++ to ++, of 5 from +++++ to ++, of 4 from ++++ to doubtful; the reaction of 9 patients became negative; and the reaction in 4 cases in which it had been negative became +++++. In all there was a change in 29 cases; there was no change in the remaining cases.

The author concludes that the effects produced were not remarkable, and that further treatment and an increase in dosage is indicated in all cases.

PATTEN, Philadelphia.

DE L'ALTERATION DU LIQUIDE CEPHALO-RACHIDIEN DANS LES PARALYSIES DIPHTHERIQUES DU VOILE DU PALAIS ET A TYPE DE POLYNEURITE (CHANGES IN THE SPINAL FLUID IN DIPHTHERITIC POLYNEURITIS AND IN DIPHTHERITIC PARALYSIS OF THE PALATE). LAVERGNE, Bull. méd. 34:983 (Nov. 6) 1920.

Lavergne has found hyperglycorachia and albuminocytologic dissociation in cases of diphtheritic paralyzes, whether general or localized.

The dissociation may be complete, with increase of albumin in the absence of cells, or partial, with a slight but disproportionate cellular reaction. These spinal fluid alterations appear early but last throughout the duration of the symptoms. They indicate that in the diphtheritic paralyzes there is, as a rule, a meningeal reaction.

DAVIS, New York.

THE MENTAL HYGIENE OF THE INDUSTRIAL WORKER. CARL SCHEFFEL, *J. Indust. Hygiene* 2:5 (Sept.) 1920.

The general attitude of the workingman is that he must get as much as possible for his work—the largest financial reward in the shortest possible time. With his concept that labor is merely labor, he does not appreciate the relationship from an economical and social point of view, to society, and accordingly maintains a distinctly unhealthy attitude. Conversely, the employer has a duty toward the laborer that is not sometimes grasped. He should aim to keep labor clean and to keep the laborer busy and amused. The interest created by the employer in the workingman for the work that is done is reciprocal in results.

Labor, or work, is divided into skilled, unskilled, monotonous and diversified. Skilled labor carries with it a certain amount of mental satisfaction (or reward), namely, the finished product, creditably done. Work that shows no results carries no mental satisfaction. Most unskilled labor is monotonous; there is no mental stimulation in it and the work becomes mechanical; and the worker becomes introspective—to the detriment of his own morale and the results accomplished. Discontent and an unhealthy mental attitude is bred by lack of interest.

The author questioned thirty-one workmen in the plant where he is employed as physician, and by their replies to the question "What are you thinking about at this moment?" found that only three were thinking about the work they were doing.

All workers present three cardinal needs: adequate and systematic physical exercise daily, mental recreation of the right sort, and a good night's sleep. Having all these things, discontent is largely eliminated. Promotion is also a stimulus to interest and a basic factor in mental satisfaction. Employers should not make promises to their employees which cannot be kept. Their deeds are sufficient promise in themselves and engender interest and ambition.

PATTEN, Philadelphia.

CONTRIBUTION A L'ETUDE DES DELIRES TOXI-INFECTIEUSES; L'ONIRISME HALLUCINATOIRE; SES RAPPORTS AVEC LA CONFUSION MENTALE (CONTRIBUTION TO THE STUDY OF TOXICO-INFECTIOUS DELIRIUM; HALLUCINATORY ONEIRISM; ITS RELATIONSHIP TO MENTAL CONFUSION). R. CHARPENTIER, *Rev. neurol.* 26:755 (Oct.) 1919.

Charpentier believes that, contrary to the common conception, although frequently found together in toxico-infectious conditions, oneirism and mental confusion, aside from this common etiologic basis, have no essential relationship and may occur equally well singly. Psychopathologically the two processes may be distinguished in that in the so-called primary mental confusion attention is generally much impaired while in hallucinatory oneirism it is, if anything, definitely exalted. Amnesia is typical of the former and characteristically absent in the latter. In mental confusion, the disturbance is fundamentally of the more essentially intellectual mechanisms while in oneirism it is expressed chiefly in the sensorial field. One must be careful, the author cautions, not to confound the true primary mental confusion, occurring in toxico-infectious conditions with what he terms the secondary confusion frequently conditioned by the oneirismic disturbance. This should not be difficult

if one bears in mind the episodic character of the latter, its lesser duration as compared to the duration of the delirium, its later appearance and early disappearance, and, finally, its general mildness, with no disorientation.

RAPHAEL, Kalamazoo, Mich.

LEFT HANDEDNESS IN EPILEPTIC, FEEBLEMINDED AND NORMAL PERSONS. RUDOLF GANTER, *Allg. Ztschr. f. Psychiat.* **75**:589 (Aug. 14) 1919.

The author has studied this question in a series of 146 epileptic patients, equally divided between the two sexes, and 155 feeble-minded patients. Among the epileptic patients, 21.9 per cent. were left-handed and 18.7 per cent. among the feeble-minded. Studies of the families of patients of these groups who, while not themselves left-handed, had members of their families who were, showed that left-handedness was present in 45.9 per cent. of the families of epileptic patients and in 45.8 per cent. of those of feeble-minded patients.

In a series of ninety-three normal families there were twenty-six instances of left-handedness, or 27.9 per cent. In the combined groups of epileptic and feeble-minded patients the percentage of left-handedness was 45 as compared with 27.9 per cent. in normal families. In the hope that some light might be thrown on this question by comparisons of the weight of the two hemispheres of the brain, the author studied the brains of 168 cases of epilepsy and feeble-mindedness. Of these, 151 were from those who had been right-handed and seventeen left-handed. In the larger number, the right hemisphere was heavier than the left. There was little difference in this among right-handed and left-handed patients—67.1 and 70.6 per cent.

BARRETT, Ann Arbor, Mich.

EPILEPSIE ET HYSTERIE (EPILEPSY AND HYSTERIA). L. MARCHAND, *Presse méd.* **28**:627 (Sept. 8) 1920.

Numerous and conflicting authorities are reviewed in this discussion of the various relations in which hysteria and epilepsy may conceivably be associated. Tentative conclusions are reached in an endeavor to clarify the prevailing conceptions of the two syndromes. Three questions are answered:

1. In the course of a series of convulsive seizures in a given case, can certain convulsions be distinctly epileptic and certain others distinctly hysterical? Yes; occasionally in traumatic epilepsy, otherwise rarely. Nonconvulsive hysterical manifestations in epileptic patients are less infrequent. However, most patients with so-called postepileptic hysteria would better be classed as pure hysteria.

2. In a series of convulsions, can any seizure be transitional between epilepsy and hysteria, or a combination of the two? No. A so-called combined attack of "hystero-epilepsy" is simply hysteria.

3. Can established hysterical convulsions eventually become transformed into epilepsy? No. Most cases formerly interpreted in this way seem rather to have been epileptic from the beginning, i. e., grand mal had merely been preceded by undiagnosed petit mal. Others belonged in Group 1, suffering from both diseases concomitantly; hysteria disappeared, epilepsy remained. It is also conceivable that epilepsy may have occurred in a person who had already had hysterical convulsions, without there being any demonstrable connection between the two.

HUDDLESON, New York.

A METHOD FOR THE QUANTITATIVE DETERMINATION OF PROTEIN IN CEREBROSPINAL FLUID. W. DENIS and J. B. AYER, Arch. Int. Med. 26:4 (Oct.) 1920.

The authors have collaborated in a series of tests on spinal fluids with the object in view of ascertaining the quickest and most reliable method of determination of the protein content. Of all methods, they have found that that in which the precipitated protein is compared to a standard of known protein content is best. The precipitating agent used is sulphosalicylic acid, and the standard is prepared by adding to a test tube 3 c.c. of a solution containing 0.3 mg. of protein per cubic centimeter and 3 c.c. of a 5 per cent. sulphosalicylic acid. The protein for the standard is prepared from human blood serum. The unknown fluid is used in a quantity of 0.6 c.c. (except in such fluids as occur in meningitis in which a large protein content is evident—when greater dilutions up to 0.1 c.c. or more are used), adding 0.4 c.c. of distilled water and 1 c.c. of a 5 per cent. sulphosalicylic acid solution. The contents are gently mixed and allowed to stand five minutes. The result is compared by means of a Duboscq colorimeter, with a 30 mm. scale, against the standard solution. Care and a little practice are necessary in the accuracy of the readings. Results in milligrams per 100 c.c. are obtained by multiplying the quotient obtained by dividing the reading of the standard by the reading of the unknown, by 0.3 (when using 0.3 mg. standard), then dividing the product by the amount of fluid taken and multiplying the quotient by 100. Inaccuracies may arise through contamination with blood or micro-organisms, or when the fluids stand a long time uncorked. The method is accurate to within approximately 5 per cent.

PATTEN, Philadelphia.

EXTRACTION D'UNE BALLE SITUEE DANS LE VENTRICULE CEREBRAL LATERAL (EXTRACTION OF A BULLET SITUATED IN THE LATERAL CEREBRAL VENTRICLE). G. L. REGARD, Rev. neurol. 26:818 (Nov.) 1919.

Regard describes a case in which a bullet was successfully removed by means of a two-stage operation, from the right lateral ventricle, specifically, at the point of division of the body into the posterior and inferior horns. The bullet, migrating from the left hemisphere to this point in the course of three days from the time of injury, had made its entry through the posterior inferior portion of the middle temporal gyrus. The clinical picture was marked by pronounced dimness of vision, myosis, severe headache, feeble tendon reflexes, somnolence and slight elevation of temperature (38.9 C.). The author remarks on the absence of aphasic disturbance, notwithstanding the temporal entry. With the exception of bilateral circular contraction in the visual fields (45-70), and pain on inclining the head forward or continued reading, the patient apparently made a very good recovery, and in seven months was able to resume his former occupation as carpenter.

RAPHAEL, Kalamazoo, Mich.

ACTION OF HORMONES AND ALKALOIDS ON IRIDES OF DOGS AFTER EXTIRPATION OF THE SUPERIOR CERVICAL GANGLION. A. MAZZEI, Arch. di Ottal. 26:249 (Nov.) 1920.

The author extirpated the superior cervical ganglion on one side in five dogs and tried the effect on various substances on the iris, using the other eye as a control. The substances were administered by the vein, with the

exception of pilocarpin and cocain, which were instilled in the conjunctival sac.

Epinephrin produced immediate mydriases on the operated side and no effect on the iris of the other eye in eight experiments. These results agree with the observations of Meltzer and Auer, and must be due to removal of inhibition which the ganglion exerts on the dilatator irides, allowing the epinephrin to act. Endospermin produced miosis on the operated side and slighter miosis on the other side. Chloral hydrate produced mydriasis in both eyes, more marked on the operated side. Atropin produced mydriasis in both eyes, much later on the operated side. Cocain administered by the vein and by instillation in the sac, produced prompt and complete mydriasis on the unoperated side, while the mydriasis was later and incomplete on the operated side. This effect and that of atropin were due, apparently, to the cutting off of the innervation to the dilator. Pilocarpin instilled in the sac and injected into the anterior chamber, produced miosis on the operated side fifteen to twenty minutes earlier than on the unoperated side. Endovarin, Witte's peptone and sodium nitrite had no effect on either eye.

REESE, Philadelphia.

TROIS CAS D'ATROPHIE MUSCULAIRE CHEZ DES PARALYTIQUES
GENEREUX (THREE CASES OF MUSCULAR ATROPHY AND
GENERAL PARALYSIS). M. BRIAND and J. ROGUES DE FURSAC,
L'Encephale 15:553 (Oct. 10) 1920.

These authors report three instances of muscular atrophy in paretic patients. One was of the Aran-Duchenne type, another of the Charcot-Marie-Tooth type and a third, perhaps neuritis, perhaps an Aran-Duchenne type—the authors are not certain. The first and third patients also had signs of tabes dorsalis. The third patient had a positive Babinski reflex on the left. There are four excellent photographs. The authors discuss the possibilities of diagnosis and conclude that syphilis caused both the mental and muscular signs.

The interesting point is that syphilis may, in the same person, produce disease of the brain (paresis), the posterior roots and columns (tabes dorsalis) and the motor cells and tracts. Cases of tabes with muscular atrophy are not uncommon. The authors show the coincidence of paresis with such atrophies. The coincidence of tabes and paresis is well known. The article serves to emphasize the various combinations occurring in syphilis of the nervous system.

KRAUS, New York.

Society Transactions

NEW YORK NEUROLOGICAL SOCIETY

*Three Hundred and Eighty-Fourth Regular Meeting,
Scientific Session, Dec. 7, 1920*

WALTER TIMME, M.D., *President, in the Chair*

LETHARGIC ENCEPHALITIS WITH SEVERE RECURRENT NARCOLEPSY. DR. WALTER M. KRAUS.

Dr. Kraus presented a boy who had lethargic or narcoleptic attacks during the day, with insomnia at night. The patient had an influenza-like attack in February, 1920, and after that he was continuously somnolent for six weeks. He could be aroused, and then recognized his family. This somnolent period was followed by inability to sleep at night, and drowsiness during the day. He would fall asleep while standing up. He was admitted to Bellevue Hospital.

Examination revealed an undersized boy of 12 years. He had a peculiar stooping, parkinsonian attitude while standing. When a narcoleptic attack began while the patient was standing up, the head would fall forward, then the torso would flex on the hips and the knees bend, and the patient would fall to the ground if not caught. There was double paresis of the facial nerves of central type, the arms were in the parkinsonian position, the right more so than the left. The fingers were in the pill rolling position. There was no change in sensation. The tongue was thick, the teeth spaced; there was a general cretinoid appearance. Since his visit to the hospital, dribbling at the mouth has been noticed. The rest of the examination was quite negative.

During the presentation the boy began to bend forward, his head drooped on his chest. When Dr. Kraus called attention to his condition he noticed that he was being spoken of, smiled, and straightened up again. His tongue protruded slightly and remained so for some minutes. Photographs taken during the narcoleptic state show him with the body almost doubled.

Combined with day sleeping there is almost total sleeplessness at night. This is the inversion of the sleep mechanism found in many cases of epidemic encephalitis.

The Wassermann reaction was negative of both blood and spinal fluid. The fluid contained 4 cells; the globulin was negative. An estimation of the total sugar in the spinal fluid showed 0.95 per cent. (normal, 0.40 to 0.60 per cent.). The colloidal gold reaction was 0011112110. The urine was normal. Red blood cells numbered 4,900,000; white blood cells 8,800; there was 90 per cent. of hemoglobin and 50 per cent. of polymorphonuclears.

At the time of presentation (at night) Dr. Kraus considered it striking that the attacks were not occurring with the same intensity as during the day. They had been frequent in the ward and had been observed that afternoon.

The case is typical of the group showing involvement of the basal ganglions.

PROGRESSIVE LIPODYSTROPHY. DR. WALTER M. KRAUS.

Dr. Kraus showed a young woman suffering from progressive lipodystrophy. Not more than twenty-five such cases have been reported. At the age of 8 it was noticed that the fat about her face began to disappear and the hips grew heavier. The disease progressed for fourteen years, and when presented there was marked atrophy of subcutaneous fat down as far as the first lumbar segment, with fatty deposits below that point. There was a condition of the legs which appeared to be edema, but the legs did not pit on pressure.

Examination revealed nothing else of consequence. Dr. Kraus suggested that this condition was analogous to the trophedema of Meige. Pathologic examinations in progressive lipodystrophy reveal a subcutaneous accumulation of fat and a proliferation of connective tissue. This is also true of trophedema except that the accumulation may involve both legs only, one leg only or one side of the body. It would appear that in typical progressive lipodystrophy there exists in the lower extremities a condition of trophedema on which is superimposed a further disorder of the subcutaneous tissues manifested as a localized multiple lipomatosis.

In the October, 1919, issue of the *Revue Neurologique*, there is a critical study of progressive lipodystrophy by Boissonas. This author concludes that the cause is not known, but that a spinal cord origin is most probable.

DISCUSSION

DR. WALTER TIMME asked whether any metabolic changes had been noted in the roentgen-ray studies.

DR. KRAUS replied that no such changes had been observed.

AN EXPERIMENTAL STUDY OF THE EFFECTS OF RADIUM EMANATION ON THE BRAINS OF ANIMALS. HALSEY J. BAGG, PH.D.

The work of the Memorial Hospital on radium treatment of tumors of the nerve tissue was reported with lantern slide demonstration by Drs. Bagg, Ewing and Quick. Dr. Bagg said that the primary purpose was determination of a suitable technic for the use of radium emanation in the treatment of brain tumors. The experiments were designed to throw light on three points: first, the nervous tissue reaction of the normal brain after exposure to radium emanation, from a histologic standpoint; second, the question of dosage and safety; third, the most practical method or methods of applying the radiation.

Four methods were used. First, unfiltered radium emanation in minute quantities, 0.2 to 1.5 millicuries each, was permanently inserted beneath the scalp in rats, and directly into the brain tissue in rats, guinea-pigs, rabbits and dogs. Second, unfiltered radium emanation in considerably larger doses, from 63 to 255 millicuries, was inserted directly into the brain substance of rabbits and dogs and left in place for varying intervals of time. Third, a comparatively large amount of radium emanation, filtered by 1 mm. of platinum and in the form of capsule applicator, was inserted into the brain of a dog for thirty-five minutes. Fourth, two large doses of heavily filtered radium emanation, consisting of 4,000 and 9,000 millicurie hours, respectively, were applied externally over the head in dogs, and a still larger dose of 12,030 millicurie hours was applied over the left temporal region of a monkey.

A long, fine, steel trocar was passed through a small hole in the skull and through it a minute glass tube containing the radium emanation was inserted into the brain. The traumatism incident to the insertion of the trocar was slight. A radiograph showed the platinum capsule in place. The capsule was removed by means of an attached fine brass wire. The so-called lead tray that was used in the external applications gave a filtration of 2 mm. of lead, and in addition 0.5 mm. of silver was used. This applicator, in the case of the three treatments that employed heavy external radiation, was held from the scalp at distances of 2, 10 and 50 mm., respectively.

The most interesting results were: First, the characteristic localized radium destruction was the most marked feature of the method wherein small amounts of unfiltered radium emanation were embedded in brain tissues. This effect was accompanied by pronounced polymorphonuclear leukocytic infiltration, which surrounded a completely necrotic area of brain tissue. The amount of destroyed tissue was about 1 c.c. in nearly all cases, generally exactly that amount, seldom less, and never more than 1 or 2 mm. more in diameter.

Second, a considerably greater amount of destruction accompanied larger doses of unfiltered radium emanation, left in the brain for shorter periods of time, although the dose, as judged by the number of millicurie hours, was the same as for the small doses, which acted over a comparatively long period.

Third, comparatively slight, if any, brain changes followed exposure to strong doses of heavily filtered external application of radium emanation, although such doses were considered of sufficient strength materially to affect the cells of a brain tumor.

It is interesting to note that a considerable amount of brain tissue was destroyed by the first method, without the animals showing any discernible neurologic disturbances, even though they were under observation for over six months, but that when the same dose in number of millicurie hours was given by means of a comparatively large amount of radium emanation, acting over a short period of time, the neurologic reactions accompanying this more severe and rapid destruction were pronounced and generally terminated fatally a few days after treatment.

The three large doses of radium emanation, heavily filtered and externally applied, showed that the normal brain, as judged by gross and microscopic examination, as well as the absence of neurologic symptoms, was markedly resistant to exposure to gamma radiation of radium emanation. In the case of the two dogs thus treated, care was taken to protect the scalp, and the animals were apparently well and active at the end of a month. In treating the monkey the radium dose was greatly increased and the applicator was placed near the scalp, thus increasing the intensity of radiation on the skin as well as within the brain. A careful study of the animal's neurologic reaction showed nothing abnormal. The animal had previously been trained, by the behavioristic method, to obtain its food by opening a puzzle-box fastened by three catches, and it is interesting to note that its reactions to the box situation were only slightly different before and after treatment, and the changes that did occur were probably referable to disturbing factors arising from a severe radium burn, which later developed over the side of the head that was exposed to the radiation. The results of the burn culminated after a month's time in the death of the animal, and the study of the brain in this case, although the radiation had been increased to the limit, showed no gross changes, except

a certain amount of anemia of the cortical blood vessels of the brain directly exposed to the radiation; a microscopic examination revealed no definite degenerative changes.

Of the four methods that have been tested, one may consider the surface application of heavily filtered radium emanation as a relatively safe procedure in the treatment of brain tumors. The burying of small doses of unfiltered radium emanation is also suggested as an especially favorable method of treatment. The relatively sudden destruction produced by comparatively large doses of unfiltered radium emanation makes this method a doubtful procedure. While the embedding of filtered radium emanation is still uncertain, it is possible that by using still larger doses than were employed in these experiments, and decreasing the filtration, this method might also be considered applicable.

THE STRUCTURE OF NERVE TISSUE TUMORS WITH REFERENCE TO RADIUM THERAPY. DR. JAMES EWING.

Dr. Ewing said that regardless of its future as a therapeutic agent, radium therapy has demonstrated certain previously unrecognized biologic properties of malignant tumors. Basal cell carcinoma is susceptible to radium, but squamous carcinoma comparatively insusceptible. Lymphosarcoma disappears readily under gamma rays.

The structural characters which determine susceptibility to radiation are of a cellular character, an undifferentiated form of the cells, rapid growth with abundance of mitoses, vascularity, especially when due to abundance of delicate capillaries, and absence of much intercellular substance. When the cells are differentiated and adult in type, when they grow slowly and mitoses are few, when the blood supply is through well formed adult vessels, and when there is much intercellular substance, the tumors are relatively insusceptible.

Neurofibroma or neurosarcoma presents features of the resistant tumor. This is unfortunate since it is so common, and since it is especially prone to recur after excision. More than 100 recurrent cases of this type have been received at the Memorial Hospital during the past two years. Most of these tumors are not recognized and are designated sarcoma. The structure of intertwining fibrils and long spindle cells is quite specific, however. They differ in reaction to radium from the soft and vascular fascial sarcomas. They first occur as apparently innocent movable tumors of the subcutaneous tissue or intermuscular planes. If surgical intervention is not successful, little aid from physical agents may be expected. Neurofibroma of the acoustic nerve has an unfavorable prognosis usually, but there is a myxoglioma of the optic nerve occurring in young subjects, which does not recur after enucleation.

Of the endotheliomas, psammoma, since usually subdural in location, might be affected by radium, especially if the radium is applied directly to the tumor. True angio-endothelioma or peri-epithelioma, composed of large polyhedral or cubical, occasionally flattened cells surrounding blood channels, occurs in the rare diffuse sarcoma of spinal meninges, and should be more susceptible to radium.

Angiosarcoma, one of the few tumors that has been satisfactorily traced to a traumatic origin, should be markedly influenced by radiation, since its nutrition is unstable, but whether slow and safe regression can be accomplished is doubtful, especially with bulky tumors.

Glioma, however, of all tumors of the brain and spinal cord, presents most of the structural features that favor susceptibility to radiation. It is the most frequent brain tumor, and is chiefly cortical. Its comparatively rapid growth, lack of encapsulation and secondary effect on surrounding brain tissue are unfavorable features. Of the three main types, astrocytoma, gliosarcoma, and neuro-epithelioma, only the first contains anything like resistant intercellular material.

Primary carcinoma of the brain assumes an embryonal type of ependymal glioma, or has the adult type of papillary adenocarcinoma. The latter usually have small cells and very delicate mucinous stroma and grow slowly. Their structure indicates a high degree of susceptibility to radium.

The group of hypophysial tumors includes cysts, chronic adenomatoid hyperplasia, cellular adenocarcinoma, glioma and hypophysial duct tumors. There are no data suggesting that radium can affect the accumulation of fluid in the cysts. Chronic hypophysial struma with acromegaly has already been definitely influenced by roentgen rays directed through the temporal regions.

The possibility of applying radium successfully and safely depends on the obstacle presented by the skull and the distance of the tumors from the scalp. These obstacles are met by increased dosage. Effective dosage of radiation can be delivered through the skull to influence the growth of cellular tumors, as has been demonstrated experimentally by the work of Dr. Bagge on dogs and monkeys. In the brains of normal dogs and monkeys a dosage of 2,000 millicuries of emanation filtered through 2 mm. of brass and placed for six hours at a distance of from 6 to 10 cm. from the skin, has not produced any structural changes, although it has produced rapid regression of deep glandular carcinomas, metastases of testicular carcinoma and retroperitoneal lymphosarcoma. A much higher dosage, resulting in caustic necrosis of the scalp, may be tolerated by normal brain tissue. When the tumor can be exposed it becomes accessible to direct application of radium or the insertion of emanation needles. If the latter are to be used, it is important that the tumor tissue should not be disturbed by partial excision.

CLINICAL RESULTS OF TREATMENT OF NERVE TISSUE TUMORS BY RADIUM. DR. DOUGLAS QUICK.

Dr. Quick said that there were few cases that had been studied clinically, and the literature is deficient. Most of the cases to which radium treatment was applied were pituitary tumors. Bielewa, Loeb, Cauvin and Gunsett are the chief exponents abroad. The general opinion is that the pressure symptoms may be relieved to a considerable degree. Pressure symptom cases are extrasellar and therefore usually inoperable. Headache and eye symptoms are relieved rapidly in many cases. When changes are due to cysts, there is less likelihood of favorable results.

There is marked improvement in pressure symptoms with checking of the metabolic and trophic symptoms. The tumor is in a favorable location for treatment. Exposures may be made from the front and sides or from the nasal route. The floor of the sella may be removed giving more direct access.

Of three cases which Dr. Quick has already reported, one patient died. This patient had a pituitary tumor removed some time previously. A second operation had been performed followed by treatment by radium radiation. The patient had profuse coryza at the time of the treatment. Meningeal involvement appeared, and the patient died. The infection had been introduced by the nasal route.

The second case was that of a young woman who had had two operations for adenoma the year before. There were blindness in the right eye, partial blindness in the left eye and projectile vomiting. She was treated externally and by the nasal route. The vomiting and dizziness were relieved. The eye symptoms were stationary. The patient, two and a half years after treatment, is able to get about and is fairly comfortable. Nothing can restore the vision.

The third patient was relieved from severe headache and pressure symptoms. Operative procedure without exposure of the tumor was carried out for exploratory purposes only. The patient returned with severe headache, which was relieved by treatment. Dr. Quick's earlier experience with intracranial tumors was limited and unsatisfactory. One was a cortical tumor in which there had previously been a right temporal decompression. This was radiated with extremely small doses; the treatment was short and the patient died. Another was a tumor in the region of the vermis. Treatment was applied on either side and posteriorly. There was improvement for six weeks, then there were cerebellar ataxia and vomiting; and the patient had to be carried to the office. Six weeks later he could walk. Then the symptoms recurred with increased pressure. A decompression was done, and the child being in poor condition died. The tumor had not been localized. The case of a child of four, who had an orbital tumor, was also cited. The mass in the upper right orbit was removed and recurred. External radiation treatment was applied for five months. The mass could be promptly reduced, but would recur. The eye was then removed, and radiation carried on in the orbital cavity. The tumor was attached to the orbital nerve. The growth was essentially a spindle cell myxosarcoma. It was not entirely removed. Radiation was applied directly to the base. Although only a short time has elapsed since the operation, recurrence has not yet been noted.

In over 100 cases of neurosarcoma at the Memorial Hospital only one was a primary growth, while the recurrences ranged from one to twenty-one operations. This type of tumor is discouraging in general. A given area may be destroyed, and another recurrence may take place somewhere else along the course of the nerve, not necessarily by continuity. It can be destroyed locally if large enough dosage is used.

Dr. Quick said that our knowledge indicates the judicious use of radium and surgery combined. Operation should not be resorted to unless radium is at hand to be applied at the same time if it be found possible to bury it in the tumor.

Two patients were presented at the meeting, the first a boy of 7 who three months before had had frontal headache, projectile vomiting, double vision and ataxia. He had had a convulsion two months before. A decompression was performed, and a neoplasm in the left lateral lobe of the cerebellum and vermis was found. Bilateral decompression was performed which relieved the pressure symptoms and vomiting. He was unable to walk when admitted, was ataxic and fell to the left. There was bilateral and vertical nystagmus. The disk outlines were hazy. Treatment consisted of three applications, of radium, one dose of 8,712 millicurie hours at the left occiput, 8,000 at the right occiput, and 7,000 posteriorly. Ten days after the first dose he was able to sit up and could coordinate better. After the second series of doses his station improved. There is now no evidence of cerebellar disturbance. Epilation of the hair is marked over the radiated area. In all 53,728 millicurie hours of radium were applied, practically all at 6 cm. distance.

The second patient, a young woman of 23, was referred to Mt. Sinai for tenderness in the right lower chest and right scapula. She had been injured six years before. The right leg was stiff and tense and dragging. For three weeks she had complained of girdle-like pains. Roentgen-ray examination showed deviation to the left, and a mass to the right of the fourth dorsal spine. It seemed to be bony and apparently was connected with the vertebral column. A portion of the tumor was removed. The infiltrating base was adherent. Eleven days after operation the patient was sent to the Memorial Hospital. The tumor tissue was found to be composed of polyhedral and spindle cells, chiefly nuclei. The tumor was classified as an anaplastic glioma. Its origin from ependymal cells was considered possible.

A large dose of radium was applied to the site of the tumor. Packs at a distance of 10 cm. with a dosage of 18,000 millicurie hours were first used; twelve days later, 11,000 at 6 cm. She was then able to move her legs more freely. Four weeks later, three doses of 6,000, 7,000 and 12,000 millicurie hours were given. In all 60,378 millicurie hours were applied, all except the first dose at a distance of 6 cm. She now has control of her extremities to a large extent. The improvement has been gradual but is pronounced.

The amount of radium found necessary for use externally was 50,000 or 60,000 if filtered. It was found relatively safe to use radium directly in the substance of the brain. Therefore exploratory operation and radium therapy should be carried out at the same time, and should be provided for in every case. In the boy's case much less radiation would have been sufficient, and the result would probably be more permanent.

DISCUSSION

DR. CHARLES H. FRAZIER of Philadelphia (by invitation) said that his interest in the effect of radium on tumors of the central nervous system was first aroused in 1914. He called attention to a number of points in which malignant tumors of the brain differed strikingly from malignant tumors in other parts of the body and why there was a larger field for radium in the brain than in other organs or structures. Much information in matters of technic must be derived from the experimental work. Dr. Frazier's experience included twenty-five cases, of which number six were gliomas, six endotheliomas or sarcomas, one teratoma and twelve undetermined. He said that pituitary lesions lent themselves to radium therapy because of the opportunities, after a sellar decompression, to place the radium tube in close proximity to the lesion. He believed the first step in the surgery of pituitary lesions was a simple subsellar decompression without removal of tissue, except perhaps for diagnosis, this operation to be followed by roentgen-ray treatment to be repeated at such intervals as seemed desirable.

As to the results obtained, in the total series, eleven of the twenty-five patients have died since the treatment began, and there are fourteen still living. Of the survivors, three are alive six years after treatment; one is alive five years after treatment; four are alive three years after treatment; two are alive two years after treatment, and four are alive one year after treatment.

Of this number, there were four in whom the tumor was removed and two of these are known to have recurred. Of the latter, one is a sarcoma of the right cerebellar hemisphere which is being treated by direct implantation of radium needles. After the last treatment there was, within two weeks, a substantial improvement.

In analyzing the results he found that the best work had been obtained in pituitary lesions and in endotheliomas. He has no evidence that radium has any influence on gliomas. The series which he has reported should not be regarded as a criterion because it has been impossible always to apply radium at such intervals as seemed desirable. Patients living at a distance from the hospital often could not be persuaded to return when requested to report. As to the conclusions, the evidence at hand justifies the following statements: 1. Radium will retard the growth of endotheliomas; two patients still under observation after six years. 2. There is no evidence warranting the assumption that radium influences the course of the gliomas. 3. Radium has proved effective in lesions of the pituitary body. Radium is now employed: (1) as a prophylactic against recurrence always after the removal of the growth; (2) as a prophylactic against recurring visual disturbances after sella decompression; (3) as an active agent by direct implantation in all inoperable growths exposed on the operating table; (4) as an inactive agent by indirect application in all inoperable growths.

Dr. H. K. PANCOAST of Philadelphia (by invitation) said that there are many reasons for regarding tumors of the brain as an admirable field for treatment by radiation. In order to determine the effects on normal brain tissue it was necessary to carry out preliminary experiments on lower animals, and dogs were selected for the purpose. Over a year ago, under the direction of Dr. Frazier and himself, some third and fourth year medical students took up the work of implanting radium tubes in dog's brains and studying the effects after a period of time which should have been sufficient to show any changes. After from four to five weeks following the implantation the dogs were killed and the brains removed and sections made of the areas treated. The exposures were made over the motor area in order that any resulting motor disturbances could be observed in addition to any visible effect on the brain tissue. They started with doses of 300 mg. hours, and the doses were increased up to 900 mg. hours. One tube of 50 mg. of radium, well filtered in order to remove all beta rays, was employed in each instance. The tube was placed directly on the motor cortex.

The results of these experiments have already been published, but brief mention will be made of the results in order to compare them with the results of other experiments by Drs. Pancoast and Frazier and others.

Microscopic sections of the brains of the dogs exposed to 900 mg. hours showed that for a distance of 2 mm. approximating the tube there was necrosis of brain tissue. Outside of this there was an area 2 mm. wide in which the blood vessels showed endarteritis, and for a distance of another millimeter there was a zone of hyperemia.

These experiments assured them that comparatively large doses of radium could be employed in the treatment of brain tumors without danger of serious destruction of brain tissue surrounding the tumor; in other words, in using a reasonable dosage of radium the effects of the radiation on the surrounding normal brain tissue can be disregarded. Other experiments were recently carried out by Dr. Pendergrass, assisted by some fourth year medical students, in order to determine the effect of larger doses of radium on the motor cortex and of implantation of radium into normal brain cortex. Two dogs were used. In one a dose of 2,100 mg. hours and in the other a dose of 2,500 mg. hours was applied over the motor cortex directly on the surface. Both dogs died in about one month. There was no paralysis and no necrosis of the flaps. The adjacent brain area was found to be congested and indurated.

Death probably resulted from the effect on the brain, but sections have not yet been made. These experiments show that there is a limit to the direct exposure which can be applied to the brain of an animal the size of a dog.

Further experiments were carried out by implantation of two needles containing 25 mg. implanted in the motor cortex of two dogs for eighteen and twenty-four hours, respectively, giving a dose of 450 and 600 mg. hours. Paralysis did not result. Both dogs died suddenly within a week, but were well two days before death. Necropsy revealed no infection of the flap or the brain. There was a general serositis, including the peritoneum, pleura and joints. The peritonitis was of a virulent form. Unfortunately, cultures were not made. The needles were carefully sterilized in alcohol for one hour before implantation, which would seem sufficient to bring about sterilization. These experiments are not conclusive.

In one experiment carried out by Dr. Bagg, in which a large dose of 4,000 mg. hours was applied outside of the skull and the brain was exposed by cross-firing to that large dosage, no subsequent microscopic changes in the brain tissue were found. Much valuable information can be gained from these experiments, and it is quite possible to base a fairly safe technic on them.

Treatment of tumors of the brain by radiation requires careful observation of these points: (1) knowledge of the type of growth to be treated; (2) knowledge of the relative amount of radiation required in the treatment of such growth; (3) size of the growth from the center to the periphery where the tumor is actively proliferating if central implantation is practiced; (4) if the growth is irregular and not truly spherical, there is still greater reason for carefully guarding against undue effects on normal brain tissue; (5) it is best to give an underdose by implantation and to supplement this by cross-firing from the outside of the head.

Drs. Frazier and Pancoast are as yet unwilling to advocate implantation of needles at the actively growing periphery of tumors until the action of radiation on brain tissue is better understood, and the margin of safety has been better demonstrated.

Tumors may be grouped in the following manner for treatment:

1. Tumors found at operation and which cannot be removed. A moderate dose of radium may be applied by implantation of the tube in the center of the growth, and this supplemented by cross-fire radiation from the outside of the head.
2. Tumors found at operation and partly removed. These may be treated in the same manner.
3. Tumors not localized and not found at operation or inaccessible at operation. Such tumors may be treated by cross-fire radiation from the outside of the head in all possible directions. This may be done apparently without any danger to normal brain tissue.
4. Pituitary growths may be treated after decompression, after partial removal or at a time subsequent to operation when there is a recurrence of symptoms. The technic employed by Drs. Frazier and Pancoast has been the application of radium below the sphenoid sinuses for a period not sufficient to cause serious damage to the structures in this neighborhood. This is supplemented by cross-fire radiation with roentgen rays through each temporal region toward the hypophysis.

DR. ROBERT ABBE (by invitation) said that during eighteen years of earnest study and use of radium in every surgical condition, he had had only three

cases of cerebral or spinal tumor referred to him for treatment, and these were postoperative, in which the gliosarcoma had been impossible to remove and the wound was closed over them. The bone, however, had been removed by trephine and rongeur so that radiumization could be given (through an inch thickness of fleshy tissue). No benefit had followed that he could see.

Dr. Abbe believed that the better technic would be to apply radium (25 or 50 mg.) in a small sterile tube without filtration of metal, directly to the tumor in the open wound under anesthesia for thirty minutes; then close the wound completely. His experience with this method in true cancer in other parts of the body, as suggested by Dr. Wickham of Paris in the early days of radium work, had given him more wonderful results than by any other method.

To some degree the skin seems to act as an insulator against penetration of the best soft beta rays which are the most fruitful of results. In fibrosarcomas of the dura he had found no benefit from radium. He had never seen cerebral disturbance from radium applications externally in human subjects.

Dr. Abbe had treated four cases of sclerosis of the cord (syringomyelia), referred to him by neurologists. In three cases no benefit followed. One case showed extraordinary beneficial results. The patient had led an active life until eighteen months before Dr. Abbe saw him. Then an ascending hemiplegia began in the leg and arm, with other characteristic symptoms, eliminating a cerebral lesion. Exhaustive study by the eminent men of the Neurological Institute gave no hope. When seen by Dr. Abbe the patient could walk two blocks with unsteady gait by aid of a cane. The arm as well as the foot had spastic paralysis, with cramps.

Radium, 250 mg., shielded by 0.1 mm. of lead, and 2 inches of gauze, was applied for from two to four hours at a time at suitable places on the spine, from the occiput to the midlumbar region, once or twice a month. In six weeks he showed improvement, and in three months he walked 4 miles daily. Later he gave up his cane and walked 10 miles daily in his business. His spasms and paralysis improved markedly, and he has had no relapse up to date, four years after treatment. He uses his paralyzed hand to cut his food and turn the key in the door. No other medication or treatment was given. The Wassermann reaction was negative.

DR. ISRAEL STRAUSS said that direct radiation of tumors at the surface and in parts of the brain where removal would incapacitate the patient, would be advantageous. In such cases surgeons should *not* remove the tumor and then apply radium. In the boy shown by Dr. Quick, the tumor was in the left lateral lobe of the cerebellum and vermis. At operation the vermis was enlarged, gelatinous in appearance and displaced to the right. It would have been risky to insert radium. It was considered far better to carry out the decompression and then to turn the patient over to the radiologists. Not a symptom of tumor is now present, but it is too early to state whether the results were attained by the radium or by the decompression.

In a case of pituitary disturbance observed some four years ago, applications were started, after sellar decompression, in the nasopharynx. The radium was put into the tumor. This was a mistake, for meningitis resulted in forty-eight hours. The procedure should have been sellar decompression to save the eyesight, then radium applied in the nasopharynx. Enough radium should be used to go through the sphenoid. The removal of the floor of the sella turcica offers an opportunity for herniation. One patient in whom there had been great improvement for a time, showed return of symptoms; a mass was

found in the nose which was subjected to manipulation with resultant streptococcus infection and death. Dr. Ewing thinks radium, if used early enough, is sufficiently penetrating to use without sellar decompression.

Glioma ought to be susceptible to radium. Surgery does not cure glioma of the brain in most instances, since it is so difficult to get at, so difficult to remove, and since it usually recurs. Radiotherapy, therefore, ought to be tried and may, when we know more about it, furnish a means of treating these growths successfully.

DR. I. ABRAHAMSON said that it was important to ascertain the effect of radium on the choroid plexus and cerebrospinal fluid.

BOSTON SOCIETY OF PSYCHIATRY AND NEUROLOGY

Regular Monthly Meeting, Dec. 16, 1920

JOHN J. THOMAS, M.D., *in the Chair*

The program was presented by members of the staff of the McLean Hospital.

APPLICATION OF THE RATING SYSTEM TO NURSES' NOTES. DR. JAMES S. PLANT.

Dr. Plant considered that nurses' notes at present are not objective enough; they cover the same field as the medical notes and have practically no final determinative value. They should be entirely conduct notes. He described the application of a rating system to nurses' notes as follows: By dividing the entire conduct field into some eighteen categories and giving in each category five ratings, a set of ninety fairly simple, definite, objective conduct entities are given the nurse, who has only, in each category, to give the approximate rating. Number 5 in each category fits the isolated ego—4, 3, 2 and 1 representing increasing adaptation. The resulting average represents a "coefficient of sociability." If for recovering and clear cases there is a high coefficient of correlation between the various ratings, the standard deviation may give us insight into the amount of confusion present. The difficulties seem large and are dependent for their solution entirely on experience. The mathematical implications are far-reaching and interesting. The chief danger lies in becoming too mathematical—in arriving at figures and curves so sophisticated as to fall of their own weight.

DISCUSSION

DR. DONALD GREGG stated that in private hospital work he considered it important to have full nurses' reports, and that he had worked out a chart which gave opportunity to record not only the conduct morning, afternoon and evening, but the occupation of the patient as well. In this way the nurse is given a chance to express how she is helping the patient, and it is more interesting for her. This record of occupation day by day gives a good idea of the progress of the patient.

DR. H. I. GOSLINE said that a study of a somewhat similar nature was made at Danvers in 1914, except that the nurses' notes were not controlled by categories. It was found that the terms the nurses used were often much

more objective than those of the physicians. The latter were apt to use terms allowing several interpretations and which expressed not what they saw but what they thought they saw. It was found that symptoms classed as hyperkinetic over a period of years often became hypokinetic in the same patient. This was expressed mathematically in the study referred to.

DIAGNOSTIC DIFFICULTIES IN THE EARLY STAGES OF MENTAL DISORDERS. DR. THEODORE A. HOCH.

DR. HOCH stated that psychoses in their early stages are subject to marked variations in symptomatology, depending partly on the personality, the causative agents and on the environmental factors. The psychotic picture may also be given a certain twist by accidental happenings of an emotional character. Thus an acute psychosis may be colored by dementia praecox-like reactions, or atypical cases of dementia praecox may have a predominating tone of depression. The presence or absence of hallucinations or delusions is of less significance than the mechanism back of them. Diagnoses cannot be made on the presence of isolated symptoms but every obtainable clue, past and present, relating to the patient and the psychosis must be carefully studied. Even then the difficulty at times is cleared up only after months of observation or after recovery. Peculiarities in conduct, eccentricities, suspiciousness, difficulties in making adjustments and other oddities in the make-up of the person are carried into the psychosis when it appears and must be given their proper place in considering the diagnosis. Depressed emotional states, delusions, hallucinations in any field, silly affect or periods of exhilaration may be found in bewildering array and surprising combinations in the formative stages of mental disorders. The greatest difficulty naturally lies in differentiating dementia praecox from manic-depressive insanity, and at times even careful analysis of every factor may leave the diagnosis in doubt.

DISCUSSION

DR. ARTHUR H. RUGGLES considered Dr. Hoch's paper valuable especially in that it indicated the difficulty in differentiating the manic-depressive and dementia praecox cases. He emphasized that, while the study of the personality and the grouping of the person according to his personality and environment is of the greatest value in trying to determine the type of psychosis, too much confidence cannot be put into making the diagnosis purely from the personality. The type of personality is almost always bound to appear in the psychosis but does not always determine the psychosis. Dr. Hoch's paper tends toward making the psychiatrist put emphasis on the combination of personality, plus environment, plus the descriptive study of the condition that is under treatment. It will reinforce the conclusion that there are certain cases that must be held without diagnosis, for often, as Dr. Hoch has said, only time and the results of the case will give the correct diagnosis.

THE "CLINICAL" PSYCHOLOGIST. DR. F. L. WELLS.

Dr. Wells stated that there is a type of psychologic work which is appropriate for the management of certain clinical and social groups. These groups include some medical and some nonmedical cases. This field of work is not now covered by ordinary medical training, nor, save exceptionally, by medical men. It is being covered more and less well by persons more or less competent in

psychology. It is the desire of responsible psychologists to organize the training in these lines of work. That they are not parallel to medicine is perhaps evidenced by their occasional collisions therewith. This at least rationalizes an effort with the conscious purpose of bringing these related spheres into better definition and harmony. Is there any part in the diagnosis or management of a person's adjustment problem which, being particularly contributed by psychology, can to advantage be handled by the psychologist? If not, no professional standing belongs to clinical psychology. If there is, it will be well to accord such standing as will keep its activities in proper limits toward society and the medical profession.

The question is raised whether intelligence examinations should be functions of the medical man or rather associated with a type of training that is non-medical. The latter situation is one that seems to be working itself out in practice, both within and outside of medical direction. Facility with these methods is gained only with much practice and quickly lost if not continually exercised. The time required is no little tax on the busy practitioner. The required portion of the medical curriculum is not exactly inviting additions to itself. The standard examinations can be made with considerably less training than is required of the physician, so that it seems doubtful economy for him to undertake them on the considerable scale which alone gives facility. These considerations weigh heavily toward the conclusion that "intelligence" measurement, like the Wassermann test, is a task for delegation to technologists specializing in that class of work.

In contact with the fields of law and medicine, but little assimilated into either, is a province dealing with behavior adjustments of the personality to its surroundings. With such problems, for example, the Judge Baker Foundation deals, and its director can assure you that the medical problem—that is, the problem with which medical education specially fits one to deal, is in most cases absent from these. It means something additional to what medical training has hitherto envisaged, the analysis of environmental and conduct history, personal capacities and tendencies. To meet it, the physician must super-add psychologic experience to his medical education, or work under conditions in which the judgment of the psychologist is available. Such problems do not come to the primary attention of those practicing or attempting to practice psychology as a profession. No competent consulting psychologist will neglect to provide for the medical factor by proper medical means. But where the controlling problem is psychologic, persons of the stamp of Thorndike, Scott or the Hollingworths seem not incompetent to have charge. Such persons may be expected to know and abide by the limits within which their competence adjoins the proper responsibilities of the physician. The value of a profession for individual practice depends essentially on what it can do to get somebody out of trouble. Clinical psychology has developed along this line; touching medicine at feeble-mindedness, the law at delinquency, though in these cases the person is brought to the psychologist rather than going to him. If psychology is to develop further as an individual practice, it must show itself able to take care of a certain class of human troubles better than they can now be met by the aid of the lawyer or physician.

DISCUSSION

DR. C. MACFIE CAMPBELL spoke of the tendency in the psychiatric service to look on the clinical psychologist with a great deal of skepticism. It may be feared that the motive is not altogether generous. It is quite true that clinical

psychologists make mistakes, but they are perhaps not more numerous than those made by the medical profession. The clinical psychologist may be a useful collaborator in many tasks which medical training does not especially prepare for and which the demands of specialized medical work do not allow time for, so that it is rather a dog-in-the-manger attitude to be too suspicious of the clinical psychologist and to overemphasize the fact that there are some who are untrained and incompetent.

It is fortunate that the American Psychological Association has itself taken up the question of standards for the clinical psychologist, so that the medical profession may be able to have some sort of guide to the personnel and will know that, if collaboration is wanted along certain lines, a group of men can be found whose training is more or less guaranteed.

DR. F. L. WELLS, in concluding the discussion, read the proposed law defining consulting psychologists.

"Any person shall be held as a consulting psychologist who shall make a practice of diagnosis or evaluation of mentality of special traits or abilities of supposedly normal human individuals, and who shall analyze and describe mentality with a view to determining mental status; or who shall make diagnosis of degrees of mental defects of individual human beings and make classifications upon such diagnosis; and who shall profess under that title to give expert advice regarding the educational and vocational treatment of both normal and abnormal individuals, or who shall publicly profess to be a consulting psychologist."

PHILADELPHIA NEUROLOGICAL SOCIETY

Regular Meeting, Dec. 17, 1920.

SAMUEL LEOPOLD, M.D., *President pro tem.*

A CASE OF SCAPULOHUMERAL MYOPATHY. Presented by DR. ALFRED GORDON.

A middle-aged woman, about five years ago began to have difficulty with her right shoulder. There was no pain. She was able to work with her right arm, and she could elevate and rotate the arm, but there was awkwardness in performing these acts. Gradually weakness of the muscles surrounding the shoulder joint developed, and the patient found it difficult to raise the arm and shrug the shoulder. There was no objective or subjective disturbance in the parts affected. The condition has grown progressively worse. Dr. Gordon said that at present the atrophy was pronounced at the shoulder girdle, the pectoralis major, supraclavicular muscles, supraspinalis and infraspinalis, the rhomboid and the serratus showed considerable wasting. The scapula was displaced, its lower angle being elevated considerably. The muscles of the arm were fairly well preserved but those of the forearm and of the hand were somewhat atrophied. All the deep reflexes of the upper extremity were abolished. Moreover the supraclavicular musculature on the left side had commenced to be involved, and the calf muscles on the right were flabbier than those on the left. Close inspection of the face showed a slightly greater fulness on the left side than on the right. Fibrillary contractions, increased mechanical irritability and reactions of degeneration were all absent in the atrophied muscles. The

knee jerks were normal and equal on both sides. Sensation was normal. Roentgen-ray examinations of the various articulations of the upper extremities have been negative.

The case seems to be one of myopathy of the scapulohumeral variety with the possibility of it being of the Déjerine-Landouzy type.

MYOTONIA ACQUISITA. Presented by DR. N. W. WINKELMAN.

Two cases were shown. The first patient, an Italian boy, aged 12, complained of stiffness of the extremities especially marked in the morning and becoming less as the day progressed. The stiffness was noticed in the beginning of muscular movements, especially in ascending stairs. He was unable to walk or run at first, due to stiffness of the legs but the stiffness gradually wore off until he was able to move about in a normal manner. His mother was insane and died some years ago. He was a seven month's baby, instrumental delivery. At 2 years of age he had convulsions which lasted for a few months. The boy said he was called "The Little Giant" by his comrades.

On examination the boy appeared to be well developed, the muscles stood out prominently, much greater than was usual for a boy of his age. All muscular movements were done stiffly at first but this wore off as was especially evident when the patient walked upstairs. At first he walked like a patient with paraplegia, but after climbing about forty steps he walked in a normal manner. The genitals were small; the hair and the skin were normal. There were no feminine characteristics. The neurologic and general examinations were negative. The reflexes were decreased at first, but as the tendons were repeatedly tapped, they became normal. The electric reactions were of the typical myotatic type. All metabolic and laboratory tests were negative except for albumin in the urine.

The second patient, a boy of 16, was well until 1918, when he had influenza. Since that time he has had difficulty in performing muscular movements because of intense stiffness, which gradually wore off as the muscular movements were continued. The stiffness never entirely disappeared. He noted an increase in the size of his muscles recently without any cause. He had noticed that when he took hold of an object he had difficulty relaxing his grip.

At times there develops a stiffness of the tongue when talking fast and occasionally a stiffness of the muscles of the mouth when eating.

Examination.—The patient was tall, well developed, with muscles above the average size. Even the muscles of mastication were very prominent. All muscular movements were at first practically impossible because of intense stiffness, which gradually relaxed, and as the movements were repeated the stiffness lessened. He showed marked perseveration in the hands and at times in other muscles, notably the eyelids. There were fibrillary twitchings all over the body. The deep reflexes were impossible to elicit because of the spasticity. They were no sensory disturbances and no increase of myotatic irritability on tapping the muscles. The electric reactions were not typical of myotonia.

The classification of these cases under the title of "myotonia acquisita" accords with the ideas of Jacoby of New York and does not agree with the idea of Oppenheim that all these cases are congenital, and that it takes some exciting cause to bring them to the surface.

DISCUSSION

DR. CHARLES K. MILLS said that he had reported one or two remarkable cases of myotonia in the International Clinics many years ago. The muscles of one patient would lock while he was walking down the ward and on several occasions he had fallen backward injuring his head. Dr. Mills thought that observations made by Kinnier Wilson and himself indicated that in most of these cases a lesion of the cerebral or cerebrospinal tonectic apparatus was present, rather than that they were affections, either myopathic or, as had been indicated by some, myelopathic. Undoubtedly the muscles may become affected secondarily. Dr. Mills had reported another case some years ago in a paper on "Clinical Problems of Cerebral Tone." This patient had been in the marine service and had a remarkable condition of perseveration which was shown just as had been illustrated here by the difficulty in unclenching his fist. The man's skull was trephined on the side opposite to the perseveration, and an area of softening was revealed in the midfrontal region, the region assigned by Kinnier Wilson as the seat of lesion in some cases of perseveration.

REPORT OF TEN CASES OF HEMIANOPSIA DUE TO OCCIPITAL INJURIES. Presented by DRS. S. D. INGHAM and H. W. SCARLETT.

This paper will appear in full in the *Archives*.

Ten case histories of hemianopsia due to occipital injuries, together with the perimetric charts of the visual fields, and charts extending ten degrees from the fixation point, were presented.

The literature of the work done on this subject during the war by Holmes, Lister, Riddock, Morax, Moreau and others, was reviewed and compared.

The salient points were: 1. The cortical representation of the macula is located in the posterior part of the visual area at the tips of the occipital lobes. 2. The periphery is represented in the anterior part of the visual area, while concentric zones from the macula to the periphery are represented in that order from behind forward. 3. Areas of the retina along the horizontal axis are projected into the calcarine fissures, while areas along the vertical axis are located on the mesal surfaces of the occipital lobe. 4. Fixation with normal vision may be retained with complete loss of one occipital lobe. 5. The fovea must be considered as an area rather than as a point, with slight overlapping of nerve fibers, thus permitting the retention of fixation and normal vision in cases of complete loss of one occipital lobe.

A case of paracentral scotoma, and one of panoramic loss of vision with retention of only fixation, were presented. The latter had 20/40 central vision in each eye, but no peripheral vision.

DISCUSSION

DR. CHARLES K. MILLS said that years ago he described a case in his book, in which there was what appeared to be a macular hemianopsia. He believed it was the first time that macular hemianopsia had ever been recorded, although Wilbrand perhaps referred to the same thing a year or two later.

HEMIPLEGIA FOLLOWING CHILDBIRTH AND PELVIC OPERATIONS. Presented by DR. A. M. ORNSTEEN.

Four cases were reported. In the first eclampsia suddenly developed in the eighth month of pregnancy, followed in about eighteen hours by a right-sided hemiplegia with aphasia. In the second a right-sided hemiplegia with aphasia and right lateral homonymous hemianopsia occurred two weeks after a stillbirth. The blood Wassermann reaction was positive. In the third a left hemiplegia occurred in a syphilitic woman, without loss of consciousness, three weeks after a complete hysterectomy was performed. These three cases were nonfatal. The fourth woman was found roaming aimlessly about the streets two months after childbirth, a victim of puerperal insanity. A week after admission to the hospital she became unconscious and developed a right-sided hemiplegia with aphasia and right lateral homonymous hemianopsia, followed in several days by death. Necropsy revealed a thrombosis of the left anterior and left middle cerebral arteries extending down into the internal carotid artery; softening and degeneration of the entire left hemisphere with the exception of a portion of the posterior part; multiple miliary abscesses throughout the cortex; patulous foramen ovale, cardiac leaflets free of vegetations.

A cerebral hemorrhage, so often seen in fatal cases of eclampsia, was probably the cause of the hemiplegia in the first patient. Whether the lesion in the left middle cerebral artery in the second patient was caused by a syphilitic thrombosis or by an embolus arising from a pelvic thrombophlebitis and passing through the pulmonary capillary circulation, is a diagnostic question difficult to decide. Again, in the third patient, was it syphilitic thrombosis or a postoperative embolus passing through the capillary plexus of the lung in order to reach the left side of the heart and to go thence to the brain? The presence of miliary abscesses in the brain of the fourth patient makes it most probable that a pelvic infection existed, and emboli arising from this region passed through the lung to the brain, where they acted as foci for secondary thrombosis. The absence of cardiac vegetations further strengthens this view. Did they pass through the lung capillaries or through the patulous foramen ovale?

The possibility of an embolus passing through the capillary plexus of the lung, and the uncertainty in pathologic diagnosis in this type of case caused the writer to review the literature for similar case reports and opinions of the respective authors.

Sir James Simpson, in 1847, suggested that all puerperal cerebral emboli arose from cardiac valve vegetations. Seven years later he added five other etiologic views: (a) escape of recently formed unorganized masses of coagulated blood from the heart, (b) a true arteritis, (c) certain diseased conditions of the blood, or certain morbid matters carried by the blood current, (d) laceration of inner coat of vessel, (e) pus or fibrin arising from puerperal phlebitis acting as a nucleus for coagulation. (This latter view must carry with it the belief that the pus or fibrin passes through the lung in order to reach the brain.)

In 1873, Thomas' theories were: (a) spontaneous coagulation in the left heart due to the hyperinotic condition of the blood in pregnancy and puerperium, (b) embolus from a uterine sinus passing through the lung and growing larger by accretion. Rindfleisch and other German pathologists admitted this possibility. Lush refused to accept the theory, and placed the blame on spontaneous left heart clots. Rusch, in 1877, believed that tiny particles from an early mural thrombus passed through the lung and lodged in the brain and by secondary thrombosis caused occlusion of the vessel. Spontaneous thrombosis of the

cerebral vessels was thought to be the cause by Scougal in 1877. Only one other case of extension of the thrombus into the internal carotid could be found in the literature. Angus McLean, in 1916, stated emphatically that an embolus could not pass through the lung unless there was a communication between some of the branches of the pulmonary veins and arteries other than by means of the capillary plexus or through a persistent ductus arteriosus. According to DaCosta, pulmonary emboli may disintegrate and smaller emboli pass to the left side of the heart. Osler states that puerperal cerebral embolism is caused by cardiac vegetations or to formation of clots in the heart because of the increased coagulability of the blood, or from emboli arising from the region of the pulmonary veins.

About thirty-five cases of puerperal cerebral embolism appear in the literature, but most of the reports are unaccompanied by opinions as to the mechanism of their production. The camp today is still divided on this subject of emboli passing through the lung capillary plexus, as it was in the past. In all probability, most of the etiologic factors expounded in the foregoing are operative in certain cases. From results of experiments made by competent workers, it seems that emboli which have lodged in the brain can arise from the venous side of the circulation and pass through the lung.

DISCUSSION

DR. N. W. WINKELMAN said that in the case at Blockley there was a massive clot in the internal carotid extending into the anterior and middle cerebrals and a patent foramen was found. Dr. Winkelman considered this important; he thought quite a clot could go through the foramen ovale because an ordinary probe was admitted with ease.

DR. ORNSTEEN said that Landis, in Norris and Landis' "Diseases of the Chest," states that in a majority of cases a small probe can be passed through the foramen ovale, as in the case reported, and that such a finding need not be looked on as abnormal. The fact that the channel runs obliquely through the auricular wall or septum and that therefore the openings of the two sides are not directly opposite to each other favors competency. These facts, Dr. Ornsteen believed, belittled the probability of an embolus passing through the supposedly patulous foramen ovale.

VARICOSITIES OF THE SPINAL CANAL. Presented by DR. THOMAS E. SHEA.

The specimen presented by Dr. Shea was removed from a body which had been sent to the Daniel Baugh Institute of Anatomy of the Jefferson Medical College for dissection; the diagnosis was cerebrospinal syphilis.

The examination of the spinal canal revealed a varicosity of the internal vertebral plexus of veins which extended from the last thoracic to the sacral vertebra. This, on examination microscopically by Dr. Crawford of the Jefferson Hospital laboratories, revealed a thrombosis of the veins which contained sarcomatous cells and were part of a sarcomatous infiltration that extended from the right testicle to the right suprarenal glands, both of which were sarcomatous. According to the history, the symptoms were mainly of a sensory character and no doubt due to pressure of the spinal nerve roots by congested intervertebral veins. The history also showed that unusual cerebrospinal pressure was present, which accounted for the cranial nerve involvement which the author claimed was due to the pressure of the cranial nerve roots between the base of the brain and its bony bed.

Book Reviews

THE OXFORD MEDICINE. By VARIOUS AUTHORS. Edited by HENRY A. CHRISTIAN, A.M., M.D., Hersey Professor of the Theory and Practice of Physic, Harvard University; Physician-in-Chief to the Peter Bent Brigham Hospital, Boston; and SIR JAMES MACKENZIE, M.D., F.R.C.P., LL.D., F.R.I., Consulting Physician to the London Hospital, and Director of the Clinical Institute, St. Andrews, Scotland. In Five Volumes. Volume 1: The Fundamental Sciences and General Topics. Volume 2: Diseases of Bronchi, Lungs, Mediastinum, Heart, Arteries, and Blood. Cloth. Price, \$62.50 for set. New York: Oxford University Press, 1920.

Under such editorship and with such a list of contributors as is presented, one is justified in expecting a work that differs from the conventional type. Ordinarily works of this type occupy a mid-position between a textbook and such larger works as Allbutt's or Osler's System. They follow conventional lines, try to avoid both extremes of too much and too little detail, and generally are nothing more than this. They rarely stimulate thought. In all of them certain articles are good and others are poor.

In reviewing this first volume one may ask why certain articles are included; but they are without exception interesting and stimulating. For example, one may ask why seventy-five pages on "Aviation Medicine" are included in a work on general medicine. The article covers the qualifications for air service, methods of examination, accidents, experimental work on aviators and the like; all interesting, but why give up space to this subject in a five-volume work on medicine?

Barker has a long article on the "Rationale of Clinical Diagnoses," readable as all of Barker's writings are and far more justifiable than the article on aviation, but one may be forgiven for contrasting it with Trousseau's lecture on "What Is Clinical Medicine," published sixty years ago.

Christian, in the introductory article on "Present-Day Medicine," speaks of the increasing appreciation of the importance of determining the functional capacity of an organ, yet his article on "Tests of Function" is so sketchy as to cover less than ten pages.

The articles so far mentioned illustrate one of the great difficulties in the preparation of a work of this sort; i. e., the distribution of space. One admires the courage of the editors who undertake a job which they know will satisfy no one, not even themselves. But why are ten pages given on what is admittedly the most important present-day task of medicine, and long articles on aviation, eugenics and hydrotherapy, which have no, or scant, place in a five-volume work?

The first volume is announced as being devoted to fundamental sciences and general topics, and it may be said that none of the article fails to come under this classification, but it is probable that about 10 per cent. of the subscribers will be most enthusiastic because of their interest in the wider aspects of medicine, while the other 90 per cent. will be dissatisfied because of the want of specific, simplified statements.

It is noted that while in volume 1 this system is said to be composed of five volumes, in volume 2 it is said to consist of six. This is an important

notice, for if correct, it justifies the first volume, in which far too much space was given to general topics, which, however important and however well handled, limited too much the room in a five-volume system for the proper subject matter of a work on medicine. In five additional volumes this can be adequately handled.

This volume covers the bronchi, lungs, mediastinum, circulation and blood. Without exception the articles are thoroughly good and such of them as have broken away from the conventional method of treating these subjects are notably good. No doubt some will criticize the sections on treatment, but to the reviewer they appear exceptionally good because they are confined to well established rational methods, omitting the useless list of therapeutic agents that have no claim on our attention other than that of old and not very respectable acquaintances.

Hoover's chapter on diseases of the bronchi is handled in just the unconventional way in which one might expect, and in reading it one can almost hear him talking in his calm, well-balanced, hard-headed way. Considerable space is given to a necessary consideration of the physiology of the bronchi and respiratory movements. One wonders why so high a percentage of his space is given to certain subjects, for example, that given to congenital malformations of the bronchi; but this is a matter of judgment on which there is room for legitimate difference of opinion.

A brief discussion is given on the effects of excoriating gases on the respiratory tree, sufficient and well put, but one may ask whether the late effects of gas poisoning are to be considered elsewhere, for most practitioners are now interested in these late effects as all are occasionally seeing ex-soldiers who are, or who claim to be, suffering from the effects of gases inhaled two or three years ago. The reviewer would be glad to know what Hoover thinks of these cases, as he saw many of them during the acute period.

It will be a comfort to many to know that Hoover has never been able to make a diagnosis of bronchiectasis except on inferential grounds, as it will be a shock to some who make this diagnosis readily and fail to realize that the diagnosis is inferential and not on evidence. Every one should read the sections on the movements of the costal margin and of the diaphragm.

The chapter on diseases of the lungs covers a wide variety of things, in general well and sufficiently discussed, although one might urge fuller details on pulmonary infarction, because practitioners in general do not know the clinical picture or realize its frequency. The subject of bronchopneumonia, one especially hard to handle without the inclusion of much that is uncertain or unimportant, is discussed sanely and well. Treatment is adequately covered and is notably free from nonsense. The value of the various vaccines in bronchopneumonia is dismissed briefly with the conservative statement that "their value is far from demonstrated."

Rose Bradford has a chapter on "Massive Collapse of the Lung," a subject which has been but sparsely, if at all, mentioned in American literature. It makes interesting reading, but one wonders whether the heading should not be "Massive Infarct of the Lung."

Diseases of the pleura are discussed by Capps, and as might be anticipated, more stress than the space warrants is put on the matter of referred pain, interesting as this subject is. In general, the chapter is well balanced and adequate, but it must have required self control to keep the paragraphs on the military experience with empyema down to a page and a quarter. The rather extensive discussion of atypical forms of pleurisy is interesting and

well justified because in most works on medicine these cases are not mentioned at all or only too briefly to convey any adequate conception of them.

One must feel sympathy for McLester, who has the chapter on diseases of the mediastinum, and the reviewer doubts whether any one could have done better in the twenty pages allotted. It is quite impossible to give anything more than the haziest description in this amount of space. However, the only numerically important disease of the mediastinum, aneurysm of the thoracic aorta, will probably have a chapter to itself.

I. C. Walker properly writes on bronchial asthma and hay fever, discussing them from the standpoint of protein sensitization. The chapters are readable and interesting, even if one does not fully agree that the condition is just as pictured. A useful paragraph on the determination of protein sensitivity is included.

An unusual and most valuable chapter is contributed by Ivy Mackenzie on the circulation in infections and toxic processes. It is not that it contains any new facts, but well-known facts are grouped in such a way as to stimulate thought on the part of the reader, which is far more important and far-reaching than giving information. The portions of this chapter devoted to a consideration of the relation of rheumatism, chorea and circulatory defects do not clarify the situation. As is pointed out, rheumatism is an indefinite term, used to cover a variety of clinical pictures, but probably it would have been better if the author had for this occasion made an arbitrary definition. The statements could then have been made definitely, and one would have known just what he wanted to convey.

One of the most important and perhaps the most interesting chapters in this volume is that by James Mackenzie on chronic diseases of the heart. One of the most readable of modern medical writers, he has a singular power of realizing what is what and of distinguishing between the important and the unimportant, even though the latter may at the moment be in the limelight. Any one who expects to find a careful and systematic discussion of the physical signs of cardiac disease will be disappointed, but if he is looking for information as to the essential things, such as the condition of the heart and the patient, he will find much to guide and to ponder. The important thing about a heart is what it can do, rather than just what its pathology is, and it is to this aspect of the question that Mackenzie devotes his time.

The last third of this volume is devoted to diseases of the blood. The articles are carefully written and are all just what one would expect.

A GENERAL INTRODUCTION TO PSYCHO-ANALYSIS. By PROF. SIGMUND FREUD, LL.D. Authorized translation with a preface by G. STANLEY HALL, President, Clark University. Cloth. Price, \$4.50. Pp. 402. New York: Boni & Liveright, 1920.

This volume consists of a series of twenty-eight lectures for laymen delivered in a simple, conversational way, and is conveniently divided into three parts.

Part 1 (forty-eight pages) is devoted to the "Psychology of Errors." In three lectures the author discusses those frequent and familiar phenomena which are observed in every normal person. Three classes of errors are considered: In the first are included errors of speech, errors in writing, misreading and misspelling. The second class is based on temporary forgetfulness, such as failing to think of a name which one knows and always recognizes, or forgetting to carry out a project at the proper time but remembering it later. The third class deals with erroneous ideas and permanent forgetful-

ness, such as mislaying things which cannot be found. Freud shows that errors are motivated in the unconscious and are the result of a conflict between two opposing tendencies, one of which is suppressed. The suppressed attains expression in the error.

Part 2 (142 pages) deals with the subject of dreams. He discusses the hypothesis of dream interpretation, the dream work, the dream censor, symbolism and infantilism in dreams, archaic remnants and wish fulfillment. One lecture is devoted to the analysis of sample dreams. The dream is conceived as a compromise between interfering tendencies and brings about the concealed fulfillment of a wish. Freud defines dreams as the "removal of sleep disturbing psychic stimuli by way of hallucinative satisfaction." In his lecture on dreams of childhood he concludes that childhood dreams are undistorted, unconcealed, direct wish fulfillment. The distortion of dreams is the result of the dream censor and is directed against the unacceptable of the unconscious wish impulses.

Part 3 (193 pages) is devoted to the general theory of the neuroses. In the first lecture, he discusses the relation of psychoanalysis to psychiatry. He further presents the meaning and interpretation of symptoms, their external and internal conditions and the mechanism of symptom formation. He states that psychoanalysis has been built up on the study of compulsion neuroses and hysteria. Several lectures are devoted to such subjects as resistance and suppression, transference and the development of the libido. In the lecture on traumatic fixation his aim is to show that traumatic neuroses arise from inability to meet an overpowering emotional experience. He further explains, in the lecture on the sexual life of man, that neurotic symptoms are substitutions for sexual satisfaction, normal or perverse. The theories of development and regression of the libido and of narcissism are clearly and adequately set forth. The last chapter contains a brief sketch of the work of analytic therapy. The author disparages the popular prejudiced view of psychoanalysis and hopes that the continued spread of the psychoanalytic doctrine will prove its worth. He sets forth its difficulties and its limitations. He realizes that a therapeutic novelty is received with great enthusiasm or profound distrust.

The greatest value of this volume lies in its conciseness, its clear exposition, and the comparative absence of technical terms. It cannot be considered an altogether unpartisan presentation for it takes little account of the Zurich school or of other psychologists. Although the material of the book is not new to workers in this field, it is a distinct contribution to the resources now available, and will prove caviar not only to the "ever increasing group of intelligent lay readers," but also to the average general medical practitioner.

THE SYMPATHETIC NERVOUS SYSTEM IN DISEASE (Oxford Medical Publications). By W. LANGDON BROWN, M.A., M.D. (CANTAB), F.R.C.P. (LONDON), Physician with charge of Outpatients, St. Bartholomew's Hospital, Physician to the Metropolitan Hospital. Cloth. Price, \$4.25. Pp. 161, with 9 illustrations. London: Oxford University Press, 1920.

The author pays tribute to the fundamental work on this subject by Gaskell and Langley, whose conclusions form the basis of the plan of the autonomic system as expounded in this book. He adopts Cannon's thesis that the results of sympathetic stimulation are, like the effects of epinephrin, katabolic, and serve to activate the body for a struggle and to increase its powers of defense. The action of the cranial visceral fibers, on the other hand, is anabolic and serve to build up reserves, fortifying the body against times of need and stress.

The relation of the sympathetic nervous system to the endocrine glands is discussed, and a brief summary is given of the physiology and clinical significance of the suprarenals, thyroid gland and pituitary body.

Separate chapters are devoted to the relation of the sympathetic nervous system to glycosuria, to diseases of digestion, and to the diseases of the circulatory system. It is said that sympathetic stimulation "both by increasing the secretion of glands which diminish carbohydrate tolerance and by inhibiting the gland which increases carbohydrate tolerance, would raise blood-sugar above the leak-point and glycosuria would result," and that persistent glycosuria may be of either organic or sympathetic origin. A good account is given of the innervation and movements of the alimentary canal; the part played by the sympathetic nervous system in esophageal and gastric spasm, reflex dyspepsia and hyperchlorhydria and atonic dilatation of the stomach are discussed. The vasomotor apparatus is shown not to be at fault in surgical shock.

A short chapter is devoted to vagotonia, which the author does not regard as a well established clinical entity.

The following paragraph gives a good idea of the point of view adopted and general conclusions reached in this book: "The evil effects of depressing emotions, of anxiety, fear, pain, and anger, receive an explanation when we see that through the sympathetic nervous system they can lead even to structural change. Designed as an intensive preparation for action or defense, the sympathetic response may be so dissociated, perverted, or prolonged as to produce through the thyroid gland Graves' disease with its dangers to life, through the pituitary body diabetes insipidus with its attendant discomforts, through the pancreas and other endocrine glands excessive mobilization of the blood sugar, which is the first stage of the metabolic disorder that culminates in diabetes; it may disorganize digestion by exciting spasms and atony in stomach and bowels, and inhibiting the secretion of digestive juices; it may keep blood pressure at a level which is inappropriate for the task of the heart and the arteries."

INFECTIOUS DISEASES. A PRACTICAL TEXTBOOK. By CLAUDE BUCHANAN KER, M.D., F.R.C.P., Medical Superintendent, City Hospital, Edinburgh, and Lecturer on Infectious Diseases to the University of Edinburgh, Major, R. A. M. C. T. F. Second edition. Price, \$14. Pp. 609. London: Henry Frowde, Oxford University Press, Hodder & Stoughton, Warwick Square, E. C., 1920.

In this second edition the author has made extensive alterations and additions. In addition to sections on measles, rubella, scarlet fever, smallpox, vaccinia and chickenpox, there are chapters on typhus and typhoid fever, diphtheria, erysipelas, whooping cough, mumps and cerebrospinal meningitis. In an introductory chapter, the problems of immunity are briefly but clearly discussed, as are also the symptoms and management of fever and the principles of diet and general therapy.

While special points of diagnosis in each disease are fully described, the main emphasis is continually placed on the disease picture as a whole, and the reader realizes that he is listening to the words of a finished clinician, who speaks from rich experience. Thus in discussing the diagnosis of diphtheria, the author stresses the point, well recognized but often neglected in practice, that a positive report of diphtheria bacilli does not necessarily mean that the patient is ill with diphtheria, and similarly, one negative laboratory

report does not indicate the absence of diphtheria. The findings of the laboratory must be interpreted in connection with clinical observations. The decreasing importance assigned to fomites and to house disinfection and the increased weight given to carriers in the spread of infectious disease is discussed in connection with each disease. The immunity acquired from attacks of contagious disease is interestingly discussed. In measles, while recurrences in from two to four weeks after the initial attack are noted, the author is apparently of the opinion that in general the immunity conferred by one attack of measles is permanent. While this is no doubt true in civil practice, the experience gained in concentration camps during the war would indicate that under these unusual conditions second attacks of measles are not rare.

The plates—a number of those depicting the rashes and the Schick reaction are in color—add to the teaching value of the book, and will be of special value to students. The advances in our knowledge of the etiology and transmissibility of infectious diseases are fully dealt with and throughout the book the references to American work on this and other topics show that the author is fully informed on the investigations of the best American, as well as British and other, workers.

The mechanical features of the book conform to the usual standard of Oxford publications.

Fifty cents each will be paid for the April and May, 1919, issues of the ARCHIVES OF NEUROLOGY AND PSYCHIATRY. Address to American Medical Association, 535 North Dearborn St., Chicago, Ill.
